MAY, 1926

Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 608 S. Dearborn St., Chicago. Subscription price: United States, Canada and Mexico, $3.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered at Chicago, Ill., as second-class matter.

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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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Published on the last Thursday preceding the date of issue by the

Simmons-Boardman Publishing Company, 608 South Dearborn Street, Chicago, Ill.

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Cable Address: Urasigmec, London

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

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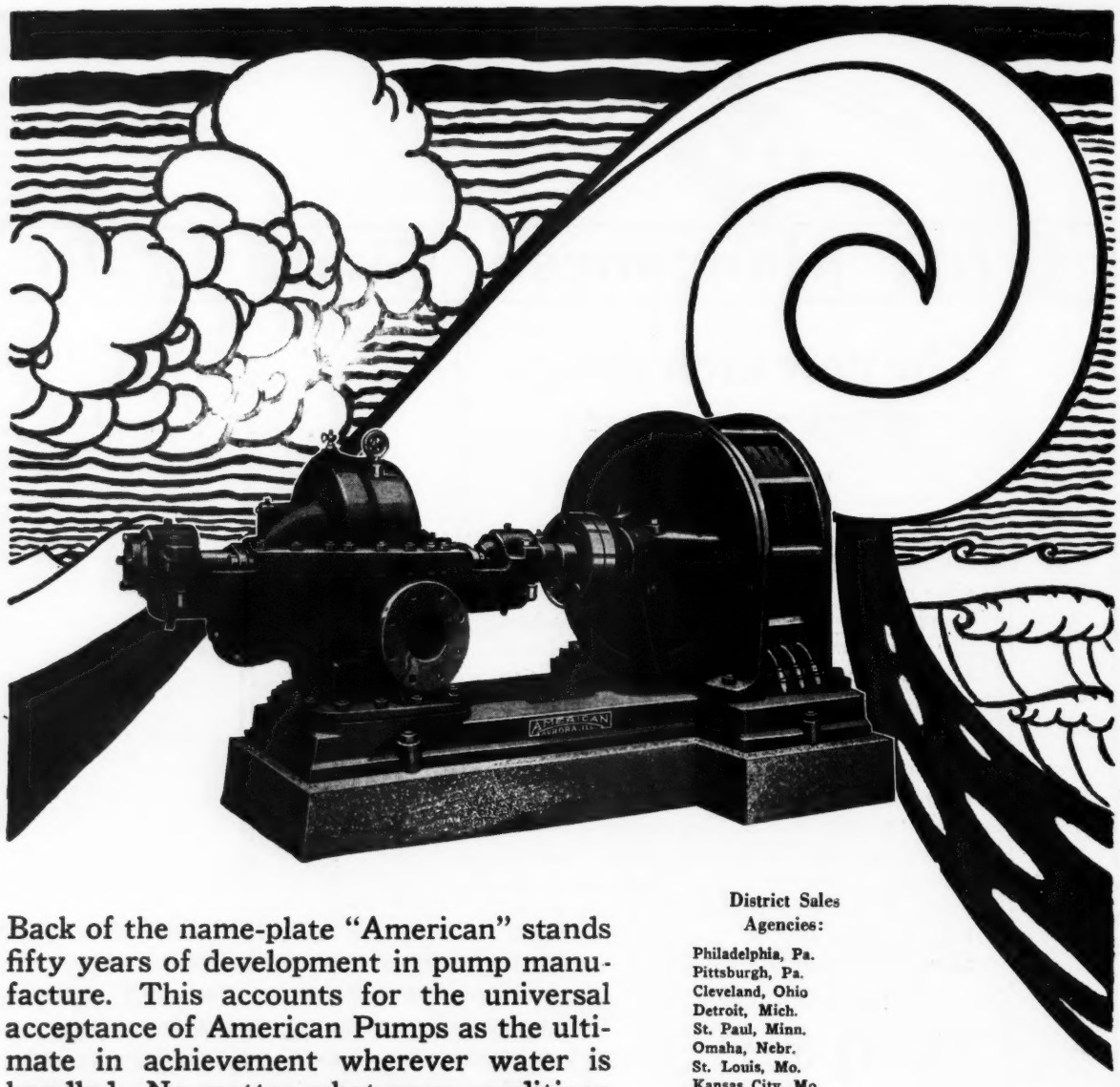
Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents. Foreign subscriptions may be paid through our London office (34, Victoria Street, S. W. 1) in £-s-d.

Railway Engineering and Maintenance is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulation (A. B. C.)



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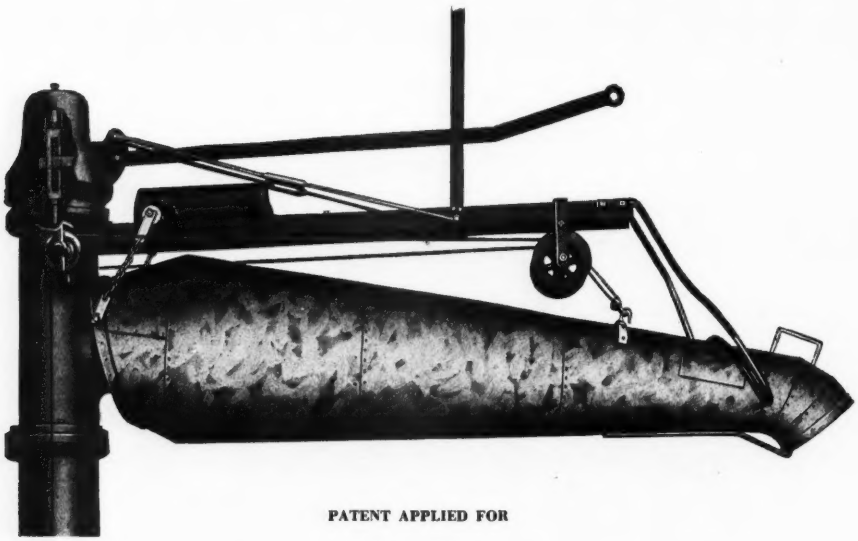

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For three newest Fairbanks-Morse models see the next page.

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First on the rails —and still first

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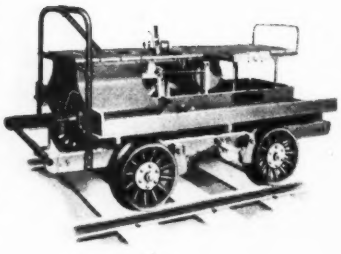
Embodying the newest developments



The Sheffield 40-B

Demand the utmost in motor-car performance—and you get it in the Sheffield 40-B. For meeting the many requirements of section and extra gang service this car knows no limitations. The best in automotive construction is incorporated in this model. The engine is of improved two-cylinder, air-cooled, valve-in-head design. Three-point suspension positively prevents misalignment. Timkin tapered roller bearings on crankshaft and axles prevent wear, absorb thrust and reduce friction losses. Automobile type pressed steel frame affords exceptional strength and lightness. Friction transmission is simple and dependable.

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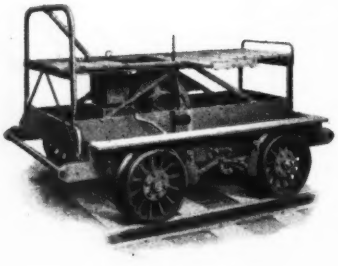

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The great popularity of this simple, powerful car is a tribute to its exceptionally fine performance. Embodied in the Sheffield 44 is the greatest forward stride in single cylinder engine, section motor car construction — perfected clutch transmission with chain drive. The clutch is absolutely fool-proof — practically indestructible. It *can't be burned out.* Control is simple and dependable. With this car, there are no delays due to broken belts.

FAIRBANKS, MORSE & CO., Chicago

Manufacturers of railway motor cars, hand cars, push cars, velocipedes, standpipes for water and oil, tank fixtures, oil engines; steam, power and centrifugal pumps; scales; complete coaling stations.

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MOTOR CARS

First on the rails — and still first

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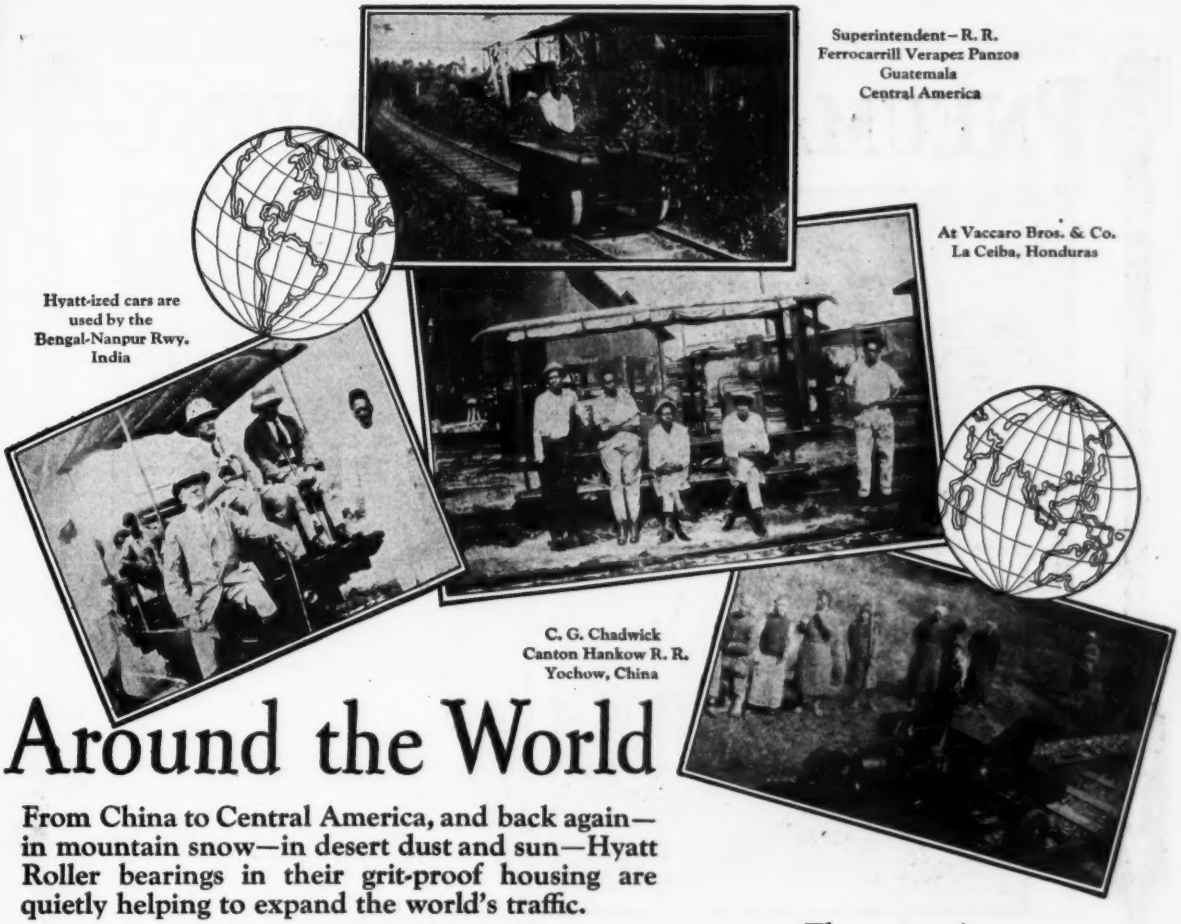

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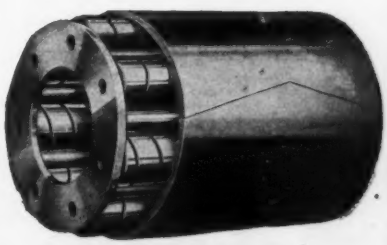

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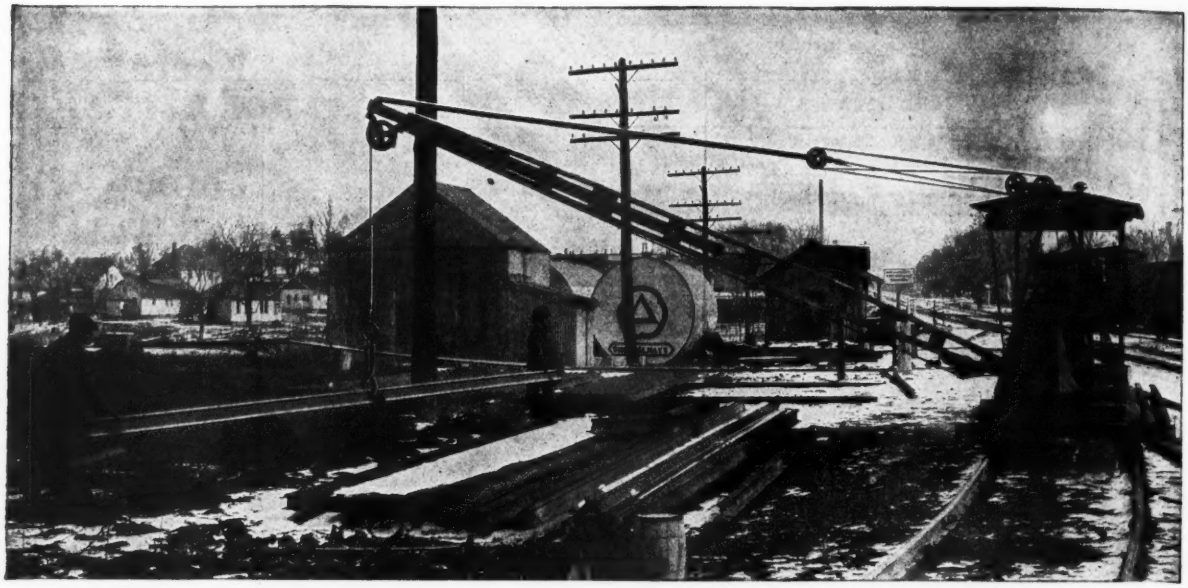


Double Saving in Rail-Laying

Parsons Rail Crane Requires Smaller Investment but Shows Greater Operating Economy

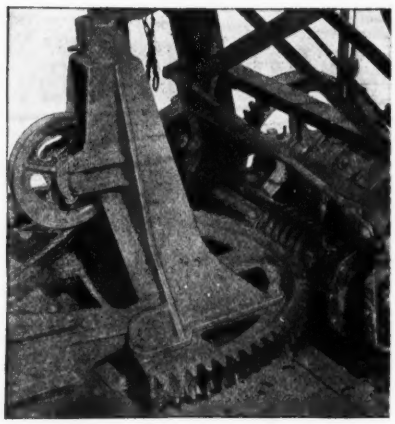
THE Parsons Rail Crane puts two important economies within the reach of every m. of w. department.

Greater range and power, backed by sturdier construction, enable the Rail Crane to decrease the cost of handling rail.

Improved design of the Parsons Rail Crane over similar equipment has brought about a remarkable saving in weight. This is reflected by corresponding savings in the cost of the crane itself and in the cost of operation.

Bulletin 26-C gives construction and performance details on the Rail Crane. A copy will be promptly mailed at your request.

THE PARSONS COMPANY, Newton, Iowa



Positive Control of Boom Swing

One outstanding advantage of the Parsons Rail Crane is the positive boom control. The boom swings by power, applied through a worm and worm-gear. This type of power-swing keeps the boom automatically locked whenever at rest, a particular advantage on curves where one rail has a super-elevation.

PARSONS RAIL CRANE

DOES THE WORK OF 10 TO 22 MEN

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Mains laid under water, in running sand, beneath railway tracks or in much traveled roadways, should be made of pipe that will reduce maintenance work and repair to a a minimum.

The first cost should be the final one for many years to come.

Bell & Spigot Joint Cast Iron Pipe is most frequently specified for such extraordinary important service.

Because of adaptability of the Bell & Spigot Joint, and the high resistance to corrosion, Cast Iron Pipe Mains require little maintenance work.

Because of the relatively short lengths, the many standard fittings and the Bell & Spigot Joint, Cast Iron Pipe lends itself admirably to construction under unusual conditions.

The tight joint, that is at the same time flexible, permits of many useful and unusual methods in building mains with Cast Iron Pipe.

Some cases showing the possibilities of the use of Cast Iron Pipe are shown on this page. We will gladly furnish information on its use under many other conditions.

Address: RESEARCH ENGINEER
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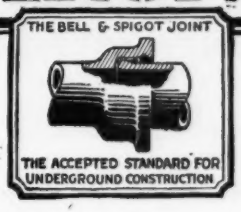
Our new booklet, "Planning a Waterworks System," which covers the problem of water for the small town, will be sent on request



Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems

The sure answer to adverse soil conditions

CULVERTS usually must be installed without regard to soil conditions. Drainage requirements determine the location. Whether the soil is sandy, soft loam or saturated with alkali salts the culvert must give long and satisfactory service.

Usually the foundation is inadequate, resulting in settlement and shifting from loads of traffic or fill. Pressure will develop in many cases, due to swelling or freezing of the soil.

The flexibility of Armco Culverts accommodates these pressures and permits the pipe to adjust itself to shifts or settlement of foundation without the slightest damage to the pipe. The pure iron from which Armco Culverts are made assures comparative culvert durability even in strong alkali soils. This durability has been proved again and again in a nation-wide investigation in which many thousands of culverts were inspected.

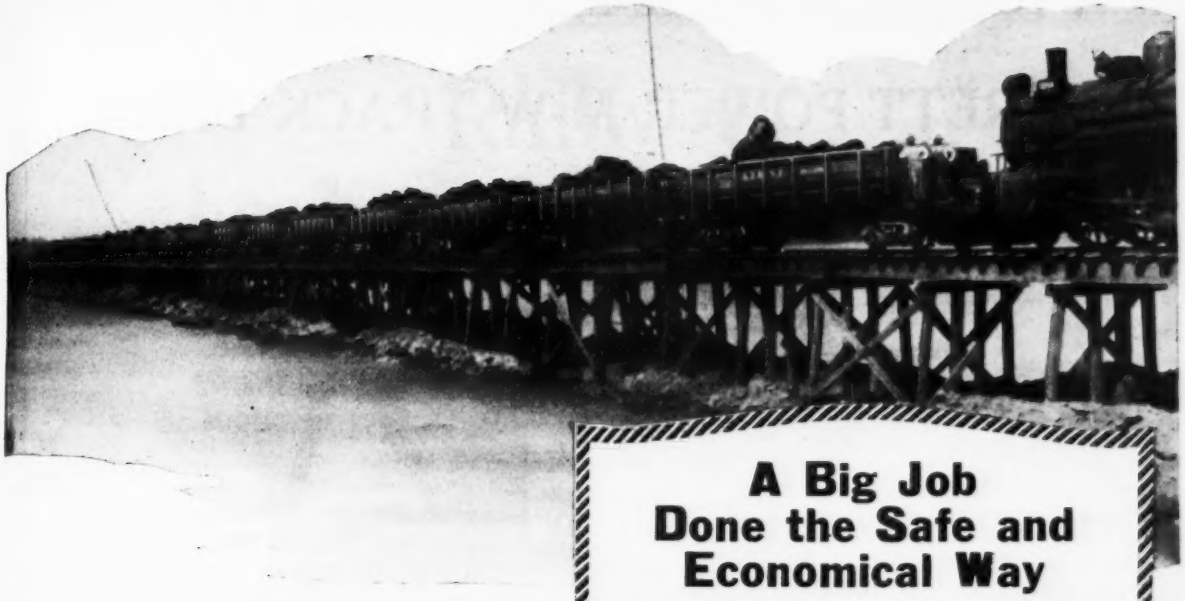
If you are troubled with a high annual culvert replacement cost, Armco engineers will be glad to help you find a solution.

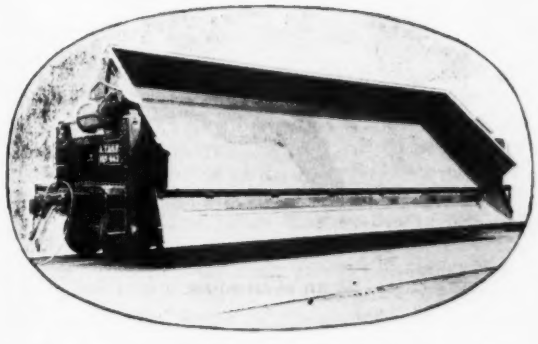
INGOT IRON

ARMCO CULVERT & FLUME MFRS. ASSN.
Middletown, Ohio

ARMCO CULVERTS

Consistent performance—because of consistent uniformity





Extension Side Dump Car in full dumped position showing how down turning door is completely out of the way when materials are dumped.

A Big Job Done the Safe and Economical Way

TWENTY car trains dumped in five minutes is the regular performance of these air operated Extension Side Dump Cars in filling bridge approaches on the Santa Fe.

This gigantic work is carried on safely and economically because heavily loaded cars are dumped rapidly from the trestle—and without excessive shock—assuring safety to men, equipment and structure.

Also the cars are loaded quickly and without delays, because there are no loading restrictions—the cars will dump anything the shovels can load.

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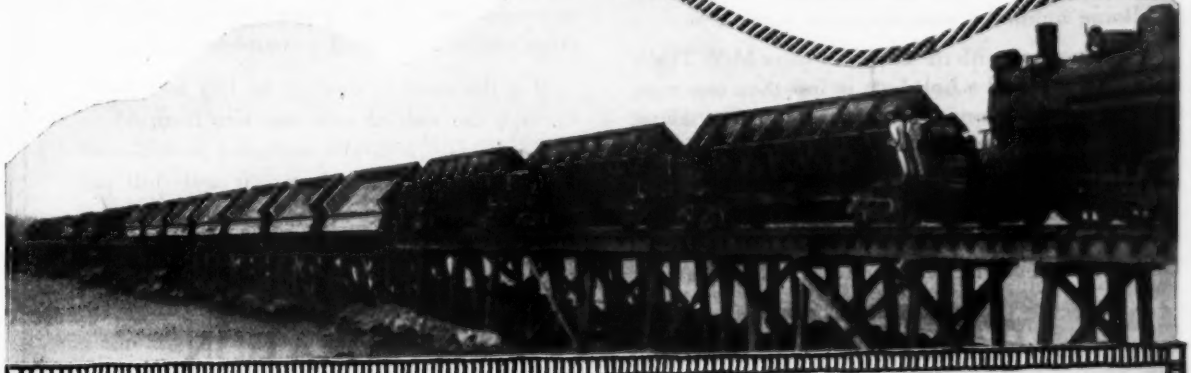


Extension Side Dump Car
Air Operated

Railway
Engineering and Maintenance

Volume 22 May, 1926 Number 5

IT MIGHT BE WORSE

MANY roadmasters have developed a habit of complaining of the character of men on whom they must depend for their supply of labor. While these roadmasters usually speak well of their foremen they contend that they do not know where they will find men qualified to fill the vacancies that necessarily occur from time to time among their foremen. Older men, in particular, like to recall the days when every man in the gang was of a type that gave promise of making a good gang leader whenever he was needed. They contend that the men in those days were generally of a higher level of intelligence than those which they must now employ. Perhaps the American roadmaster will not find his lot so hard if he compares his men, all of whom are members of civilized races or have become civilized after generations of contact with the Caucasian race, with the semi-civilized races that are employed in maintaining tracks in many other parts of the world. The lower efficiency of such forces is evidenced by the conditions confronting the supervisory organization of the Sudan Railway, described elsewhere in this issue. In constructing a new line on an extension of this property the laying of track, ballasting and surfacing required the employment of 700 men to obtain an average progress of from 1 to 1½ miles per day. Surely any American roadmaster could accomplish the same work with a force not exceeding one-third this number of men of the kind he is accustomed to handle.

WRECKING CRANES ON BRIDGE ERECTION

THE ERECTION of a heavy plate girder span on the Elgin, Joliet & Eastern, as described elsewhere in this issue, presents an illustration of co-operation between the transportation and engineering departments whereby wrecking cranes have been made available for use in bridge erection work. While this represents no departure from the practice prevailing on some roads there are other railroads where, for lack of proper co-operation or other reasons, these large capacity cranes, which are provided only for emergency work, have not been placed at the disposal of the bridge erection force with the result that less satisfactory methods of erection must be adopted.

The suggestion that wrecking cranes be used for bridge work should not be construed as offering a means of avoiding the purchase of an adequate complement of locomotive cranes for the bridge department, since wrecking cranes are no more suitable for the routine work done by the bridge forces than a locomotive crane of capacity adapted for such routine work would be capable of use on work such as that described in the article in question. The point is that the railroad bridge forces are so rarely called on to handle bridge work requiring large capacity cranes or bridge derricks that the purchase of such equipment cannot be justified, but that if wrecking cranes and their crews can be borrowed from the transportation department when needed for such occasional work demanding their use it will be possible to conduct such erection work much more economically than would otherwise be possible.

BE SURE THAT YOUR PIPE LINES ARE LARGE ENOUGH

THE RAILROADS are subjected to excessive costs for pumping water and are suffering from curtailed water supplies at many of their water stations because of inadequate sizes of pipe lines. There are several reasons for this. One is to be found in the determination of pipe sizes by guesswork rather than by actual calculations according to the principles of practical hydraulics. Another lies in a failure to make proper allowance for increases in the demand for water with the growth of traffic, and a third is the reduced efficiency of old pipe lines because of tuberculation or incrustation. This unfortunate condition is by no means limited to the railroads. Many municipal systems are suffering from the same short-sighted policy on the part of those responsible for pipe line construction in years gone by.

The unfortunate feature of this condition lies in the high cost of its correction. If a pump proves inadequate the cost of replacement is offset to a considerable extent by the salvage value of the facility replaced, because the old unit may be removed and re-used elsewhere at moderate expense. A water tank of inadequate capacity may be supplemented by an additional tank at a considerable saving over the cost of a single new tank of sufficient size to provide the entire storage capacity required, because the old tank is practically 100 per cent efficient in so far as capacity is concerned.

These advantages are not offered by an inadequate pipe line. The cost of taking up an old pipe line is so great that it is seldom economical to remove the old pipe with the idea of using it elsewhere, while a pipe line that has become so inadequate as to demand the construction of a new line is generally so inefficient that it is usually advisable to provide a new line of such diameter that it will be adequate without any assistance from the old line for other than standby or alternative service.

In view of these considerations it is of utmost

importance that pipe lines be of adequate size, not only for the present but for years to come. Even if the pipe line installed is considerably larger than necessary for present requirements the additional investment for a pipe line larger than that now required will afford some immediate return in the form of reduced pumping costs, because the reduced velocity of flow through the oversize pipe will reduce the friction head.

Hydraulics is not as exact a science as some of the other branches of physics which are applied to engineering. The development of practical rules and formulas has, therefore, been much more dependent on experimental work. But sufficient tests have been made to afford practical rules for the determination of pipe sizes for various volumes of discharge. Charts of friction in pipe lines and fittings, such as are shown elsewhere in this issue, are capable of practical application to almost any problem of pipe line layout with the assurance of reasonably accurate results. The serious consequences to follow the installation of inadequate pipe line and the ease with which the proper sizes may be accurately determined should convince anyone of the fallacy of depending upon guesswork in determining the sizes of pipes to be used in even the most simple pipe line problem.

A DEMONSTRATION OF THE ECONOMY OF STABILIZING FORCES

A REDUCTION of 43,000 men or 30 per cent in the fluctuation between summer and winter forces in the maintenance of way department from 1923 to 1925, as set forth on a following page, indicates the marked progress that is being made in the stablization of these forces. That this reduction was not due to the curtailment of work is shown by the fact that while the payroll was reduced more than $12,500,000 in 1925 as compared with 1923, the smaller force actually installed over $16,000,000 more material, from which it is fair to assume that they actually did more constructive work in the latter year. In fact, since the tendency in the prices of materials was downward during this period, the amount of these materials actually used was undoubtedly greater than the comparison of the figures indicate.

These figures give weight to the arguments that have long been advanced in support of more uniform forces. In the first place, they indicate that these forces were more efficient, since the amount of material used is an index of the work done. They merely support what has long been recognized in the abstract but seldom recognized as applying to railway service, that the experienced man will not only use material more intelligently and, therefore, more economically but that he will also install more of it in a given time than a "green" man. He also requires less supervision, is less liable to accidents and in general requires less attention in the matter of housing and care.

Another conclusion to be drawn from these figures is the fact that the reduction in the spread between the summer and winter forces was effected almost entirely by the curtailment of the summer or "extra" forces, rather than by an increase in the winter forces, for the average number of men employed in January and February, 1925, was only about 3400 more than in the same months of 1923, while the force employed in August, 1925, was nearly 40,000 less than in the same month of 1923. The reduction in the summer forces indicates that much of the work for which extra men have been employed during the summer has been transferred to the winter months, while the failure to make a proportionate increase in winter forces indicates further that the men were employed more profitably during the winter. This assumption is borne out by the experiences of those roads that have made the greatest progress in stabilizing their forces for they have found that it is possible to do a large amount of constructive work during the winter season with little or no addition in force, but merely employing the men normally retained, more constructively. Any such improvement is a net gain for any labor spent in "chasing snow-flakes" or other unproductive work is waste.

Another consideration is the probable effect on the labor market if the railways had employed 40,000 more men than they did last summer. There was a surplus of labor throughout the summer, as a result of which labor was more content and more efficient than would have been the case if there had been a shortage. It is entirely possible that if the roads had employed as many extra gangs in 1925 as they did in 1923, this surplus of labor might have been converted into an actual shortage with its resultant demoralizing effect on labor. In any event this condition would have greatly increased the shortage and would have added to the cost of maintenance work by reason of the increased turnover that always accompanies a reduction in labor supply.

The figures referred to above show that the railroads are making marked progress in the stabilizing of their forces. Unfortunately, however, this is confined as yet to a limited number of roads. With the information now available, other roads are warranted in giving more consideration to the application of this method to the work on their own roads. As this is done the results will be cumulative.

IS A HEAVIER TRACK STRUCTURE WARRANTED?

IS OUR present day track construction too light for the traffic it is called on to carry? Will an additional expenditure for heavier rail and fastenings, more and better ballast and other details entering into a modern track allow a sufficient return in decreased expenditures for upkeep to warrant the investment. These are questions which most roadmasters and division engineers and many of the higher officers will answer in the affirmative, yet few of these men can support their arguments by data. For this reason the article entitled, "Improvements in Track Materials Cut Maintenance Costs," which appears on a following page, deserves the close study of every maintenance officer.

There has been a steady development in the track structure in recent years. Rail of 75-lb. and 85-lb. sections has given way to that of 110-lb., 115-lb. and 130-lb. on many divisions; cinder ballast has been replaced by gravel and gravel by stone; stronger joints have been installed and more tie plates, rail anchors and other accessories used. At the same time and in spite of these improvements the impression remains among those most directly in touch with maintenance work that the roads can still afford to go much further in this direction with economy.

In advocating additional expenditures for this purpose, however, the maintenance officers face the necessity of convincing the managements of the merits of their recommendations. This is a day of proof in business. The railway officer wants to be

shown the return he will secure for a given expenditure. He has a right to expect such proof and it is the duty of the maintenance officer who recommends additional expenditures to produce the proof in support of his arguments. Yet, relatively few men make the necessary effort to secure and present such supporting data.

In fact, in not a few instances, they have failed after securing new and better materials to show any reduction in cost, but have devoted their energies to efforts to advance new reasons why they cannot reduce their forces. Of course, the new material enables them to secure a higher standard of maintenance with the same forces and if this is the result desired by the management, no further explanation is necessary. However, when increased expenditures are advocated on the ground of the economies they will effect, a maintenance officer defeats his own argument when he fails to produce these economies and makes it more difficult to secure additional authorizations in the future.

There is a need for a closer study of the effect of stronger and better track construction on the cost of maintenance. In relatively few instances is the question of safety a factor today, because the track construction almost universally offers an adequate factor of safety. In its place the motive prompting further expenditures today is that of economy which is reflected in some instances in a higher standard of maintenance but which to an increasing extent in the future must be warranted by a lower cost of maintenance.

RAILROADS SPEND MORE MONEY FOR TRACKS AND STRUCTURES

IN 1925, $415,000,000 were spent for improvements in roadway by the railroads of the United States, a fact which should have a particular significance to the man engaged in maintenance of way and structures. This figure is especially noteworthy when it is compared with similar expenditures made in the three previous years, as illustrated in the table below.

	Total Additions and Betterments	Equipment	Roadway and Structures	Per Cent Roadway to Total
1922	$ 429,000,000	$253,000,000	$176,000,000	41
1923	1,059,000,000	687,000,000	381,000,000	36
1924	875,000,000	490,000,000	385,000,000	44
1925	754,000,000	339,000,000	415,000,000	55

In this table it is seen that there has been a steady increase in expenditures for roadway and structures in both amount and percentage, although for the last three years there has been a decrease in the total expenditures for all improvement work done on the railroads. Thus, in 1923 the railroads spent $381,000,000 for improvements to roadway and structures, or 36 per cent of a total of $1,059,000,000 appropriated for all capital expenditures, while in 1925 expenditures for roadway and structures totaled $415,000,000, or 55 per cent of the entire sum of $754,000,000 chargable to capital account.

This trend towards greater expenditures for improvements in tracks and structures is evidence of the increased attention which the railway managements are giving to the fixed portions of their properties, and also indicates a general improvement in the condition of the railroad as a whole. When the railroads were suffering from severe congestion and a car shortage in the fall of 1922, it was essential that they make expenditures along lines that would result in the most immediate increase in capacity. Consequently they placed large orders for new equipment and as a result 4,360 new locomotives and 232,060 new freight cars were placed in service in 1923.

Since then improved operating methods and better condition of equipment have been effective in eliminating congestion and the roads have been in a position to consider opportunities for increasing the capacity of their lines through improvements which would also promise economy in operation. The result has been greater expenditures for grade reduction, second track, improved locomotive facilities, coaling stations, better track construction and other additions and betterments to the fixed property that increase capacity but which primarily reduce the cost of the transportation and maintenance. Since 1922 there has been no car shortage or serious congestion except such as have been the results of peculiar conditions, for example, conditions arising out of the boom in Florida. Consequently the railroads have been able to concentrate expenditures primarily on improvements designed to increase the economy of operation and while the replacement of antiquated locomotives and cars with modern equipment will effect marked economies in operation, the primary opportunities along this line lie in the improvements to roadway and structures.

As an example of the opportunities along this line is the replacement of rails with heavier sections. The latest statistics available as to the weight of rail in track are those of 1923, which, by comparison with earlier years, show what has been done in increasing the average weight of rail. Thus the table below shows the miles of rails by weight in main line tracks on Class I roads in 1920 and 1923 and the change in the mileage of different weights of rail occurring in the intervening three years. It shows that the mileage of tracks having rails weighing less than 80 lb. decreased 10,979 miles, while the mileage of lines with rail weighing 80 lb. to 99 lb. increased 8,092 miles and the mileage of lines with rails weighing 100 lb. or over increased 10,203 miles. That the

Mileage of All Main Tracks with Various Weights of Rail on Class I Roads

	1920	1923	Increase or Decrease
Rails weighing less than 80 lb.	123,990	112,011	10,979 decrease
Rails weighing 80 lb. to 99 lb.	94,071	102,163	8,092 increase
Rails weighing 100 lb. and over	33,902	44,105	10,203 increase
	251,963	258,279	

railroads have continued to increase the mileage of heavier rail and decrease the mileage of lighter rail is evidenced by the fact that statistics for rail production during 1925 show that 1,636,633 tons of rails weighing 100 lb. or over were produced in the United States in that year, a quantity exceeding by 170,771 tons the production of these heavy rails in any previous year.

There is, in view of this, every indication that the railroads have adopted a policy for increasing their standards of track construction and for improving the fixed properties generally, and as improvements in the character of construction carry with them improvements in the standard of maintenance it is clear that the maintenance of way departments of the railroads will be called on for increased performance in the years to come. Surely, there will be opportunities for all in the development of this field.

New Books

Proceedings of the Forty-Third Annual Convention of the Roadmasters' Association. 175 pages, 7 in. by 10. Bound in cloth. Published by the Association. T. F. Donahoe, general supervisor of road, Baltimore & Ohio, Pittsburgh, Pa., secretary.

This volume contains the report of the annual convention held at Kansas City, Mo., on September 22, 23 and 24, 1925 at which committee reports were presented on the programming of section work, inspecting and identifying ties for renewal, the roadmasters' responsibility for the proper relations with the public, and the methods and costs of weeding track. These reports and the discussions which followed their presentation contain much information of value to all concerned with maintenance problems and give evidence that there has been no retrogression from the high standards attained by the association. The program also included addresses and papers by a number of railway officers which are also published in the proceedings. These covered: "The Essentials of Maintenance Work" by C. E. Johnston, vice-president and general manager, Kansas City Southern; "The Treatment of Soft Roadbed" by A. N. Reece, chief engineer, Kansas City Southern; "Raising the Standard of Maintenance Forces" by Colonel W. F. Green, vice-president, St Louis Southwestern: "The Roadmasters' Opportunity for a Broad Constructive Service" by L. W. Baldwin, president, Missouri Pacific, and "You Are a Part of the Great Game of Railroading" by W. B. Storey, president, Atchinson, Topeka & Santa Fe.

Railway Engineering and Maintenance Cyclopedia. 1072 pages, 2500 illustrations, 9x12 in. Bound in leather and cloth. Published by the Simmons-Boardman Publishing Company, New York City. Price, cloth $8, leather, $10.

The Railway Engineering and Maintenance Cyclopedia is a second edition of the Maintenance of Way Cyclopedia (published in 1921), changed in name to indicate its scope more accurately and entirely new in contents and arrangement. This Cyclopedia is a companion book of the Car Builders Cyclopedia and the Locomotive Cyclopedia, published by the same company, which have long been the standard books of reference on railway mechanical department subjects. It has been prepared in co-operation with the American Railway Engineering Association and the Signal Section of the American Railway Association, both of which organizations appointed committees to assist in this work.

This Cyclopedia has been edited by a staff composed of E. T. Howson, editor (western editor of the Railway Age and editor of the Railway Engineering and Maintenance), W. F. Rench, managing editor (formerly supervisor, Pennsylvania System), Frank M. Patterson (formerly district engineer, Chicago, Burlington & Quincy and later senior civil engineer, Bureau of Valuation, Interstate Commerce Commission), and Neal D. Howard (formerly in the engineering department, Illinois Central). The manuscript for the Bridge section was prepared by P. G. Lang, Jr., engineer of bridges, Baltimore & Ohio System; that for the Building section by A. L. Sparks, architect, Missouri-Kansas-Texas Lines; that for the Water Service section by C. R. Knowles, superintendent of water service, Illinois Central, and that for the Signal section by B. T. Anderson, superintendent of signals, Chesapeake & Ohio.

This book is divided into two major subdivisions, definition and text. In the former are included more than 2500 definitions of terms used in railway engineering maintenance and signaling work, which have been prepared with a view to aiding in correcting the costly confusion in terminology which now exists. Thus where the American Railway Engineering Association or the Signal Section of the American Railway Association has adopted a definition, it has been accepted. Use has also been made of definitions adopted by the American Wood Preservers' Association and other authoritative organizations. Where a more detailed discussion of a subject is included in the text pages a reference to the chapter is added to facilitate further study.

The outstanding departure of this edition from the earlier edition consists in the assembly of correlated information in the chapters, which chapters are, in turn, collected into sections devoted to track, bridge, building, water service and signaling with a general section covering those subjects which do not belong specifically in any one of the other sections. Each chapter treats a subject thoroughly from the standpoint of the materials and equipment employed and the manner of their use, these materials and equipment being illustrated freely. In many cases the discussions are supplemented by the manufacturers with more detailed descriptions of their products, which descriptions appear on separate pages immediately following those of the text and forming an integral part of the various chapters, in this way concentrating all information regarding a subject and adding greatly to the convenience of the user of the book in his investigation of a particular subject.

Indicative of the character of the book are the chapter headings of the track section, as follows: Roadway Standards, Grading and Grading Equipment, Drainage and Ditching Equipment, Snow and Ice Removal, Weed Destroyers, Ballast, Ballast Application and Cleaning, Ties, Rail, Rail Renewal and Maintenance, Rail Joints and Fastenings, Rail Joint Accessories, Tie Plates, Anti-Creepers, Switches, Frogs and Crossings, Guard Rails, Switch Stands, Derails, Bumpers and Car Stops, Fencing, Highway Crossings, Signs, Motor, Hand and Push Cars, Track Jacks, Shovels, and Miscellaneous Tools and Equipment.

This book should prove a valuable aid to the officer in charge of maintenance work who desires to keep informed regarding the equipment or materials available to meet a particular problem, to the operating or executive officer who must pass on the recommendations of his assistants, to the purchasing agent who must keep fully informed regarding the wide diversity of materials available for use, as well as to the supervisor or foreman who must use these materials.

An Unusual Form of Concrete Viaduct

Railroad Bridge Forces Erect Heavy Girder Span

Combination of Conditions Imposes Obstacles Calling for Carefully Developed Plan of Procedure

WHAT IS one of the longest, if not actually the very longest, girder span ever provided with a concrete ballast deck was erected recently by the Elgin, Joliet & Eastern in a bridge across the Desplaines river at Joliet, Ill. The span is noteworthy also by reason of the method of erection, which was carried out entirely by the regular bridge maintenance forces of the railroad under the direction of A. Montzheimer, chief engineer. The span comprises the westerly and channel span of a single track bridge across the river, the remaining portion of the structure comprising deck girder spans of shorter length. The new span, which is 124 ft. 10 in. long, center to center of bearings, replaced a deck truss span which had been built with a single-strength truss on the one side and a double-strength truss on the other side with the idea that it would later serve as the middle truss of a three truss span for double track (the line is double-tracked beyond each end of the bridge) but with increasing weight of locomotives and cars this old span proved too light and had to be replaced.

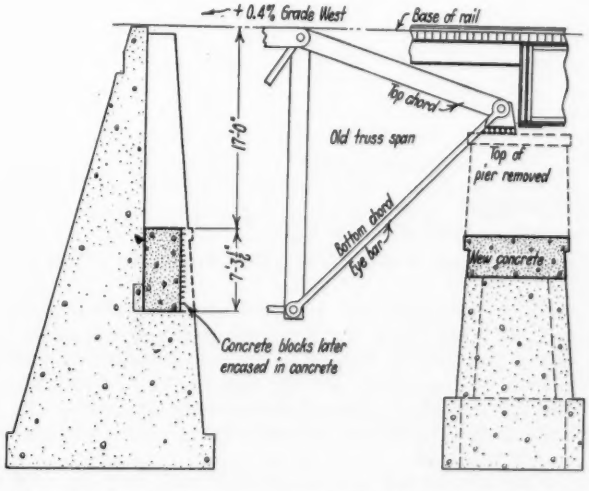
As originally built the bridge had several spans to the west of the channel but in 1923 these spans were replaced by an embankment and a new concrete abutment was built to carry the west end of the channel span. The remainder of the sub-structure consists of piers which had originally been built of stone masonry and were later encased in concrete.

Girders Are of Heavy Design

The girders of the new span, 128 ft. 4½ in. end to end and 11 ft. 4½ in. deep, back to back of flange angles, are spaced 8 ft. 4 in. center to center. The web plates are ⅝-in. thick by 136 in. deep, and are made up in six lengths. The flanges are composed of two 8-in. by 8-in. angles, with four cover plates, 23 in. wide by 1 in. thick, of which the longest is 126 ft. 10 in. long and the shortest 76 ft. 4 in. The span was designed for Cooper's E-70 loading, according to American Railway Engineering Association specifications, except that impact was taken at 50 per cent of the live load.

Wrecking Cranes Were Used in the Erection Work.

The deck slab, which was built in place on the girders, is 12 ft. 4 in. wide, 1 ft. 8 in. thick on the center line of track, and has curb walls on each side 1 ft. 6½ in. high to retain the ballast for the track. The top of this slab at the inside faces of the curb walls is one inch lower than at the center so that the slab will drain to a row of 2-in. cast iron pipe extending through the slab at intervals of 4 ft. These drain pipes are 5 ft. long, and as seen in one of the photographs, are inclined outward so that the drip will clear the bottom flanges of the girders. The girder span and slab complete with track and ballast weigh approximately 520 tons.



Details of the Changes made in the Abutment and Pier.

Conditions at Site Complicate Erection

The problem of replacing the old span with a new one was a difficult one and imposed the usual requirement of minimum interference with traffic. A study of the conditions led to the conclusion that the girder span be erected at one side of the old bridge and rolled into place after the old span was released. An important advantage of this plan was that it permitted the building of the slab deck in place, thus affording better construction and also permitting the erection to be carried out in one operation, rather than to require the placing of a temporary open floor after the erection of the girders and the subsequent re-

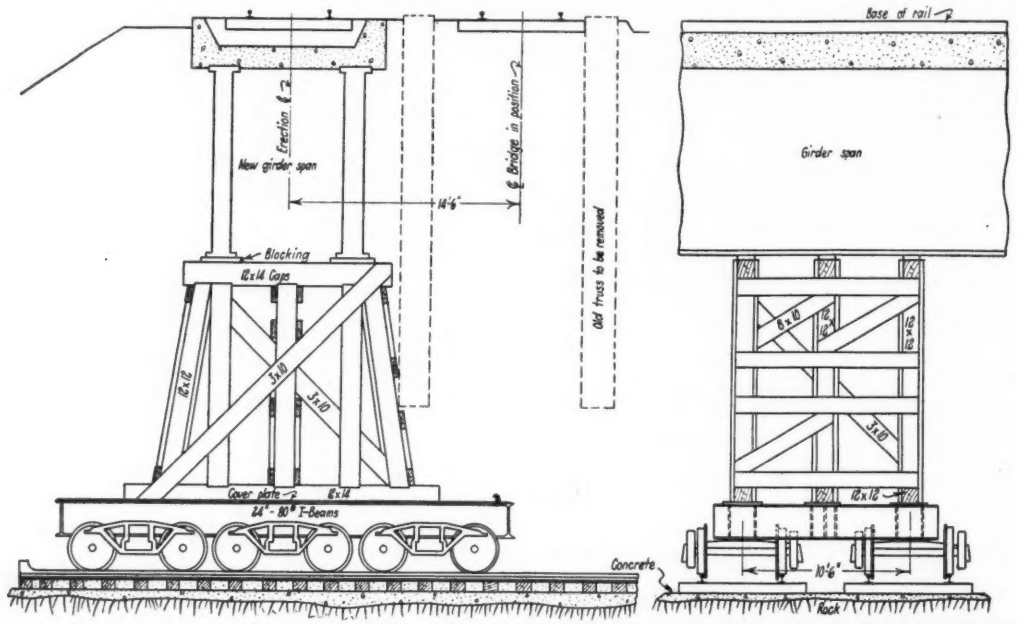
After the Old Truss Span had been Lowered and Tipped Over to One Side to Make Room for Rolling in the New Girder Span.

placement of this by a piecemeal erection of slabs.

However, the erection plan adopted was not simply a matter of rolling the old span out and then rolling the new span in, as a peculiar arrangement of the old truss span introduced several complications. The west end of the old span was carried on shoes under the ends of the bottom chords supported on a bridge seat 24 ft. 3½ in. below base of rail, this bridge seat built with its bottom chords inclining upward and its top chords inclining downward to meet in a connection with bearing shoes resting on the top of the pier. Thus the bridge seat on the abutment was too low and that on the pier was too high to provide suitable bearings for the new girder span which, with its bearings, required a bridge seat elevation 17 ft. below base of rail.

At the pier this condition was corrected by cutting down the pier about four feet below the required elevation and then building up a new cap with its top 17 ft. below base of rail. This was carried out by supporting the ends of the two spans on falsework. Provision for falsework for the truss span was simplified by the fact that this span had previously been blocked up on frame bents erected at each panel point, because this span was of inadequate load carrying capacity. At the abutment, support at the required elevation for the new girder span was provided by constructing two pre-cast concrete blocks to be set into place on the bridge seat as soon as the old truss span was removed. These blocks were 3 ft. 1 in. by 5 ft. 4 in. in plan and 7 ft. 3 in. high.

As the abutment had been built for double track the pocket for the bridge seat was wide enough so that the new girder span could be erected with its west end inside of the pocket alongside the old span. There was therefore nothing to prevent the rolling of the girder into final position when the old span was released. The important problem was to provide a rolling rig strong enough to carry the weight of the span. But this was greatly simplified by one favorable condition. The river is notably shallow at ordinary stages and the bed of the stream is solid rock. This condition led to the development of a plan under which the



Side and End Elevations of the Carriage on Which the Girder Span was Erected and Rolled Into Place.

comprising the bottom of the pocket or recess set back into the abutment. Therefore, it was not possible to roll the old span to one side, as the end of the span would not clear the face of the abutment beyond the sides of this pocket. The pier at the east end of the span was built to a level 8½ ft. below base of rail to accommodate a four-girder, 80-ft., deck span, and in order to support the east end of the truss span on a bridge seat at this height the truss span had been runway or track was placed directly on the stream bed with provision for supporting the girder span at the desired elevation by means of falsework towers placed on top of the rolling rigs instead of following the usual plan of placing the runway on falsework of such height that the rolling rigs would be directly under the span.

The stream bed was cleaned off to bare rock, which was then covered with a thin slab of concrete to pro-

vide a smooth surface with a downward grade of one-half inch in 50 ft. in the direction in which the bridge was to be moved. This concrete surface formed an excellent bed on which to place the tracks for the rolling rigs. One runway was provided under each end of the span, each one consisting of two standard-gage tracks spaced 10 ft. 6 in. center to center and having a length of about 50 ft.

Details of the Rolling Rigs

Each rolling rig consisted of a structural steel frame supported on six car trucks from 70 ton freight cars. These frames were composed of 24-in. 80-lb. I-beams, seven placed lengthwise of the trucks and two crosswise at each end. The longitudinal beams were arranged in three groups, two beams over the center line of each track and three on the center line between tracks, each group being covered with a one-half inch cover plate. All of the longitudinal beams were connected to the transverse beams at each end of the frame by standard hitch angle connections. Each frame served as a support for a frame tower of three bents each, which served both as falsework on which the girder span was erected and also as the carrying frame for rolling the span into place.

The girders weighed 72 tons each and were delivered on flat cars which were run out on the old span and were unloaded by wrecking cranes stationed at each end of the bridge which set the girders on the carrying towers. This involved no particular difficulty in the case of the derrick on the enbankment at the west end of the bridge, but the outriggers for the wrecking crane standing on the 80-ft. girder span had to be supported on falsework carried up from the stream bed.

On the day set for the change of the spans the first operation was to remove the rails and ties from the old truss span. The next operation was to cut through the stringers, top chords and bottom chords at about the center of the east end panel of the span with oxy-acetylene torches. While this was being done a hitch was taken around the east end floor beam with tackle from a wrecking crane stationed on the 80-ft. span and as soon as all the members had been cut through the severed end of the span was lifted out in one piece and lowered to the stream bed. This wrecking crane and another standing on the embankment at the west end of the bridge then took hitches on the old span and shifted it eastward far enough to bring the west end clear of the abutment, following which the span was moved northward far enough to clear the falsework bents upon which it had been resting and then lowered to the stream bed. Lines were then carried under the south bottom chord to a hitch on the north bottom chord so that by hauling in on the lines the span was caused to roll over on its side well out of the way. Following this operation the two pre-cast bridge seat blocks were set in position on the abutment, following which the bearing castings for both ends of the spans were set into place. All was then in readiness for rolling the new span into final place. This was done with the aid of four stone jacks set in an inclined position with their bottoms against the edges of the track ties and their upper ends against the lower edges of the south cross beams of the two rolling trucks. The span was readily moved by operating one jack on each truck simultaneously, which made it possible to alternate the operation of the jacks, one of which was run back and reset while the other was in operation. The complete shift was made in about 30 min.

How the Jacks were Placed for Lifting the Girder Span Clear of the Tower.

After the Girder Span was Rolled Into Place. Note the Row of Drain Pipes.

A General Elevation of the Girder Span Before it was Rolled into Place. Note the Carriages Under Each End of the Span.

Ingenious Method of Lowering Span

The span was lifted clear of the carriages and lowered on the bearings by means of groups of ordinary bridge jacks set on the carriages and working against 12-in. by 12-in. posts bearing against the bottoms of the girders. These posts had been previously hung in proper position against the sides of the bents of the carrying towers with their tops against the girders

and their bottoms at such elevation above the blocking as was necessary to afford ample clearance for inserting the jacks when ready to carry out this work.

Enough blocking was provided between the tops of the bents and the lower flanges of the girder so that when the blocking was knocked out after lifting the span clear there was sufficient clearance between the span and the bents after the span had been lowered to the bearings. With the span in final position the closing up of the track was a simple matter of requiring a minimum of time because the rails had been cut and drilled to make an exact fit with the track on either end. The total interruption to traffic during the time that the change in spans was made was approximately six hours.

More Work to be Done

Certain operations remained to be completed after the span was turned over to traffic. These included the encasing of the pre-cast concrete bridge seat blocks in a jacket completely closing up the pocket in the face of the abutment to the new bridge seat level. To accomplish this more effectively the precast blocks had been cast with a large number of dowels projecting from their faces for the purpose of securing a thorough bond with the new concrete. A sidewalk will also be provided on one side of the girder span, supported on steel brackets attached to the stiffener. angles of the girders.

Provision has been made for the future placing of a concrete deck on the 80 ft. girder span to the east of the new channel span, the girders in this span being of ample strength to carry this additional load. As the 125-ft. span is much deeper than the 80-ft. span, provision was made for supporting the west end of the 80-ft. span on a bracket projecting from the east end of the longer span. This bracket was formed by riveting heavy plates on each side of the web plates of the girders, these plates projecting a sufficient amount beyond the end of the span to afford support for a heavy cross girder which, in turn, carries the end of the 80-ft. girder span. This bracket construction has been carried out in such manner that whenever it is desired to lower the 80-ft. span for the purpose of permitting the construction of a concrete deck this supporting cross girder may readily be lowered the desired amount. The new span was designed and fabricated by the American Bridge Company.

What Material Waste Means*

By E. H. HUGHES
General Storekeeper, Kansas City Southern, Pittsburg, Kan.

MORE than five million dollars was spent by the Kansas City Southern for materials and supplies in 1924, not including new equipment. From 30 to 35 cents out of every dollar earned by the railroad in 1924 went back in some way in the purchase of materials and supplies used in the maintenance and operation of the railroad.

From the prices of the tools and supplies in common use in the maintenance of way and structures department it is possible to compute the number of miles it is necessary to haul a ton of freight to pay for any item, the figures being based on the revenue per ton-mile in 1924, which was $0.0109.

That means that if we waste a dollar we have to haul a ton of freight 92 miles before we have paid for that loss. Take an adze costing 98 cents. If one of these should drop from your handcar going to work tomorrow morning, and you should lose it, our railroad would have to haul a ton of freight about 90 miles before the value of that adze would be made up. To pay for a drill bit costing $1.75 requires the hauling of a ton of freight 160 miles at our gross revenue rate. A claw bar costing $2.44 requires the hauling of a ton of freight almost 240 miles.

If we should lose a broom—which costs 51 cents—or if it should be stolen, it would mean that we had hauled a ton of freight almost 47 miles for nothing. A dry battery costs us 25 cents. I don't know that it is ever done, but if a man should go away from his motor car without turning off the ignition switch, for every battery that would be exhausted we have lost the haul on a ton of freight 22 miles.

We all handle switch lamp chimneys, but how many of you realize that our railroad has to haul a ton of freight almost eight miles to pay for every switch lamp chimney that is broken. The figures is 7.34 miles, to be exact. If we get careless and break a red lantern globe we have to haul that ton of freight 83½ miles. It might be well to bear in mind that a red lantern globe costs almost twice as much as a white lantern, frame and all, complete. There is only 30 cents difference in the price of a red globe and the price of a white lantern complete.

Quite a few of the track shovels turned in to the supply car in its trips over the line bear evidence of having been used for prying, and are bent out of shape. Others come in with clean breaks at the top of the shanks. If the practice of using track shovels improperly can be broken up, it should be done, as every shovel broken through improper use means the waste of $1.51, or expressed in terms of ton-miles, the hauling of a ton of freight 138½ miles for nothing.

A scythe, complete, costs us about $2.38. If we keep these scythes through the winter let's put a little oil on them to prevent rust. We must haul a ton of freight 229 miles to pay for each scythe.

Cost of Waste of Small Items

And there are the smaller items. A pound of cotton waste, for example, costs us around 15 cents, at present market prices. We are buying a new waste now, to our specifications, and a lot better grade than we formerly bought, but we have to haul a ton of freight 14 miles to pay for a pound of it.

The little switch lamp burners cost us 34 cents. It is pretty hard to realize that they cost two or three times as much as a No. 2 lamp burner we use at home. Yet if we throw one of these away before we have gotten the life out of it, or lose one, we have lost the earnings on a 1-ton freight haul of 31 miles.

The nutlocks that we buy, and have adopted as standard, cost us $44.49 a thousand. I doubt if there are many of you, when you look at a little keg of nutlocks on the railroad, realize that almost fifty dollars is tied up in that keg. When we figure out what they cost apiece, we find it is 4½ cents. If we only get a penny for

*Abstracted from a paper presented at a recent meeting of the Kansas City Southern Maintenance of Way Association at Shreveport, La.

hauling a ton of freight a mile, and we lose one of these things, it means we have to haul a ton of freight four miles to pay for that one little nutlock.

If one track spike gets buried in the mud or gravel we have to haul a ton of freight one and two-thirds miles for nothing. We use a lot of track spikes, and every keg that is lost or gets away from us represents the haul of a ton of freight 564 miles for nothing.

We see a lot of tie plates lying around the tool house, and where we are laying rail. If we lose one of them, we have to haul a ton of freight 22½ miles for nothing.

There are many ways that we might effect economy in the use of material. Perhaps the greatest good we might get out of this is to think of material in terms of money. If we have a piece of material in our hands, consider it as so many pennies or dollar bills, which we want to spend to the best advantage, to get the most out of them.

One way in which you men who work on the track can save money for our railroad, is by keeping the right-of-way cleaned up, and getting in to your headquarters every piece of material you find, whether it is scrap or good second-hand material which might be used again. The mechanical department in particular benefits from this, because it gets no small amount of good second-hand material in this right-of-way scrap, in the way of couplers, brake beams, etc.

Roughly, our railroad employs a little more than 5,000 people. If every man on the railroad would save only a penny a day, that would amount to $18,250 in the year. And I believe we could say without any hesitancy that every man can save 10 cents a day, which in a year would amount to $182,500, and would give our railroad that much more money to spend on worthwhile things.

Now, judging from the splendid way everybody has come across and put his shoulder to the wheel in our business-getting campaigns, our safety first campaigns, and others that we have put on, I think that every man here will feel like going back home and doing a bit of preaching to his men and those who are not here. I feel that if we will all get into this thing we will not only be able to accomplish that saving of 10 cents a day, but go a whole lot higher.

An Easy Method to Determine Friction Losses in Water Pipe*

By F. J. WALTER
Assistant Engineer, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

THE determination of the proper and economical size of pipe lines in connection with railway water supply facilities is dependent very largely upon the frictional losses. A number of formulæ for the calculation of these losses have been advanced by various experimenters; however, these formulæ are practically all of the same general form and differ only in the exponents used. As the calculation of these losses is often quite laborious, charts have been prepared from which they can be determined readily, both for straight pipe and standard elbows and tees. The charts cover only those sizes of pipe which are usually encountered in railway water service work.

The chart showing the friction loss in new cast-iron pipe is based upon the Hazen and Williams formulæ and assumes average water conditions, and that the pipe line is well laid. On the righthand side of this chart another series of curves have been plotted showing age factors to determine the loss in pipe lines of any size. This factor is simply a multiplier to be used with the loss for new pipe. For example, the frictional loss in 8-in. pipe 15 years old is 1.6 times that shown for new pipe. These age factors have been determined upon the assumption that the increase in loss of head on account of tuberculation amounts to 3 per cent per year, and that this decreases the diameter of the pipe at the rate of 0.01 per year.

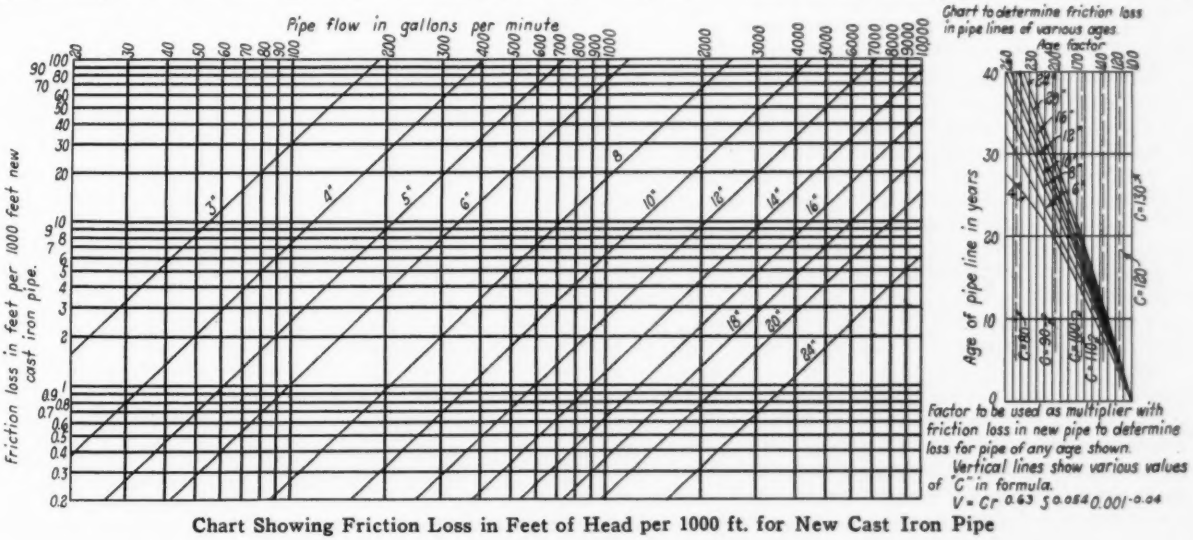


Chart Showing Friction Loss in Feet of Head per 1000 ft. for New Cast Iron Pipe

The Haven and Williams formulæ is a modification of the well-known Chezy formula. It is believed that

*A monograph forming part of the report of the Committee on Water Service, presented before the convention of the American Railway Engineering Association, in March, 1926.

it gives values which more nearly represent average conditions than do the earlier formulæ. With any of these formulæ, it must be remembered that the results are approximations only, based upon the results of a vast number of experiments and represent average conditions. Individual cases may be encountered which differ from these calculated results.

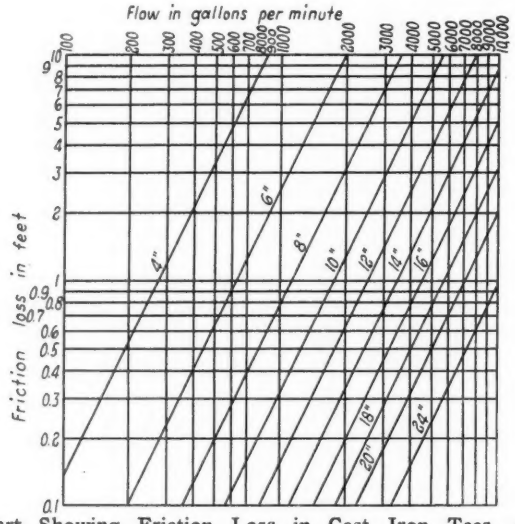


Chart Showing Friction Loss in Cast Iron Tees, and Standard Screwed and Flanged 90-deg. Elbows (A.W.W.A.)

In the construction of new pumping facilities, we are principally concerned with the determination of the pumping head at some future date, so that ample power may be provided to take care of future operating conditions. In such cases, it is the usual practice to determine the frictional losses for a pipe line from 15 to 20 years old. In using the charts in such instances, it will be found that an age factor multiplier of 1.63 will give the losses for pipe lines varying in age from 13 to 20 years, depending upon the size of the pipe used.

In certain instances it will be found advisable to make further allowances for the character of water to be handled. Experience has demonstrated that with waters of low alkilinity, tuberculation increases at a much more rapid rate than the average and in such cases the age factor must be increased. On the other hand, where cement-lined cast-iron pipe is used, it has been found that the rate of tuberculation is very materially retarded.

On the chart showing age factors, lines have been drawn for various values of the coefficient "C" in the formula used. These charts are thus applicable to pipe lines of other material, such as wood stave, or riveted steel, as well as uncoated cast-iron and centrifugal cement-lined cast-iron pipe, by using the multiplier corresponding to the proper value of "C" for the particular material. These values of "C" may be considered as follows:

For cement lined cast-iron pipe, "C"=135 to 140.
For wood pipe, "C"=130.
For riveted steel pipe, "C"=110 to 120.
For uncoated cast-iron pipe, "C"=120.

Unfortunately, a comparatively small number of experiments have been made in the past to determine the loss of head through bends and fittings and of these by far the greater number have been made using small malleable iron, short radius, screw-end elbows and tees, so that the results are not strictly applicable to standard cast-iron fittings of the larger sizes and greater radius as used in present-day pipe line construction.

Graphs have been prepared showing the losses through standard elbows and tees. These graphs are based upon experiments made by Alexander, Williams and Brightmore, using cast-iron fittings ranging in size from 3 in. to 30 in., and give results which probably more nearly approximate the actual losses through this class of fittings than do the results obtained through the use of formulae based upon experiments made on small size fittings of extremely short radius.

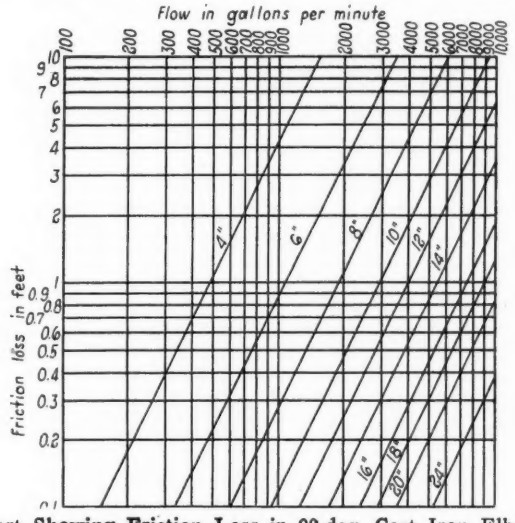


Chart Showing Friction Loss in 90-deg. Cast Iron Elbows (A. W. W. A. Standard)

National Conference Treats of Highway Crossing Problem

THE NATIONAL Conference on Street and Highway Safety, held at Washington on March 23, 24 and 25, adopted the following recommendations concerning the elimination and protection of grade crossings.

The elimination of grade crossings by grade separation or by the relocation of highways or railroads, should be carried on under a proper program which would first eliminate the most dangerous crossings on thoroughfares carrying heavy traffic. The program should have due regard to the relative costs and advantages of eliminations or other methods of protection and also to the enormous costs involved which would impose excessive financial burdens, resting in the last analysis on the public, if the work were attempted on too large a scale. Any program suggested should have the most thorough joint consideration by the proper authorities. Grade crossings should be avoided wherever feasible in the location or relocation of highways or railroads. Underpasses for the elimination of grade crossings should not be narrow or obstructed and sharp turns in their approaches should be avoided. The authority to order grade separation or protection at grade crossings should be vested in the commission having jurisdiction over the railroads while the authorities having charge of the highways should plan the improvements and initiate proceedings for the highways under their jurisdiction. Provisions should be made by law for prompt decisions.

Railroad grade crossings should be safeguarded in every reasonable way, having regard to the volume of traffic, and warning signs, pavement markings, gates, and mechanical or electrical devices should be standardized as far as practicable. A clear view along the track in both directions should be provided and to this end the placing of railroad cars near the crossing should be discouraged. Sharp curves or any conditions in the pavement near the crossing which tend to divert the attention of the motorist should be avoided. The proper state authorities should be empowered to designate dangerous grade crossings at which motorists must stop.

Metropolitan Club Discusses Rail Anchors*

Supervisors at New York Considered Advantages and Economies of Anti-Creepers and Studied Their Application

RAIL creeping gives rises to numerous objectionable conditions in the track structure such as the bunching of ties and ballast, the closing of expansion, the distortion of gage, the kinking of rails, the loosening and pulling of spikes, the shearing of spike heads and track bolts, and the splitting of ties. It also imposes conditions which invite derailment, such as the crowding ahead of switch points and frogs, causing spring-rail frogs to stand open and forcing the track out of line because of bunched rail.

There are many theories as to the cause of rail creeping, but it is a general opinion that it is due to the wave motion preceding a moving train or locomotive. The amount of creeping varies with local conditions, being aggravated by soft, springy subgrade. It is further governed by the weight of rail, the ballast used and the rate of grade. On a single track line rail creeping usually occurs in the direction of heavy tonnage, highest speed and descending grades, while on double track it is usually in the direction of traffiic. On single track it is often found that the rails creep in opposite directions. There is a general belief that the right hand rail always goes with the current of traffic, while the other rail will creep in the opposite direction. On double track one rail will creep more than the other. It is hard to account for these conditions.

Anchorage is Necessary

In view of the many conditions resulting from track creeping, it has been found necessary to use some means of eliminating this destructive force, and the use of rail anchors is accepted as the means to this end. Modern rail anti-creeper devices, which have been evolved from the old strap rail anchor, have a holding power ranging from 4,000 lb. to 25,000 lb. This does not mean that one having the greatest holding power is the most efficient, as it is found that ties can be moved by a force of from 1,000 to 5,000 lb., depending upon the nature of the sub-grade, and the kind and quantity of ballast used. However, if the anchor is designed so that the extra strength may be utilized as a safety factor in re-application, resistance to rough usage, corrosion and other like conditions, then this extra strength is of some value. Rail anchors are only required to exert a force equal to that required to push the tie through the ballast in which it is embedded.

Recommendations

To summarize good practice in the use of anti-creepers the following recommendations are made:

(1) Anti-creepers are necessary for the maintenance of good track unless conditions are such that the slot spikes are sufficient to prevent the rail from creeping.

(2) Slot spikes should be used except where their disuse has been made standard; at least three anchors should be applied to replace the slot spikes.

(3) Anti-creepers should be applied when the rail is laid or as soon thereafter as possible.

(4) There is an advantage in applying anti-creepers even if conditions do not permit the application of a sufficient number to prevent all creeping of the rail. There is no doubt, however, that the use of enough anti-creepers to hold the rail is justified, as the life of the rail is increased by preventing the battering of the joints.

(5) There is a difference of opinion as to the proper placing of anti-creepers. Most members of the committee think they should be scattered; thus, if slot spikes are used with four anti-creepers to the rail, one anti-creeper should be applied at each tie opposite the slot spike and the others at the same tie at the quarter. If slot spikes are not used many think that all the anchors should be installed at adjoining ties at the center of the rail so that each joint will be forced to take care of the expansion and contraction.

(6) At insulated joints and at switches, anti-creepers should be applied to hold in both directions, since the opening and closing of the joints cuts the fibre of the insulating material and also decreases the life of the joints. Creeping rail at switches throws the points out of adjustment and forces the rods and lugs against the timbers.

(7) The number of anti-creepers necessary to hold the rail depends entirely upon conditions and the roadmasters and supervisors familiar with these conditions should be the best judges as to the number required.

(8) While the savings effected by anti-creepers are difficult to estimate on account of varying conditions it is believed that the use of anti-creepers will save enough in two years to pay the cost of their purchase and installation. (C. E. Doty, supervisor New York Central, chairman of committee.)

Discussion

R. S. Dunkle (Penna.): With regard to Conclusion No. 2, I would like to know if the committee would agree to word the last part to read, "As many anchors should be applied to replace slot spiking as there are ties covered by the rail joints."

Mr. Doty: The committee specified three anchors to take care of three-tie joints, as the center tie helps to hold as well as the slot spike ties, therefore, the additional creeper was recommended, i. e., instead of two anti-creepers to take the place of slot spikes, it was made three. My personal opinion is that two slot spikes are better than two anti-creepers; they will hold more.

J. Kiley (L. V.): We have not used any slot spikes since 1916 and we have used six anchors to a 33-ft. rail as a maximum and in many places we use only five. Now, with the 39-ft. rail we use seven where we used six, and six where we used five and with that number of creepers we don't have any undue trouble. We do not space ties and we do not put anchors on joint ties. The anchors are put on so that they bear on the same tie and secure the joints.

G. W. Morrow (N. Y., N. H. & H.): We don't use the slotted joint any more, and haven't for the past three years and on our 39-ft. rail we put on 7 creepers to a rail, or 14 to a panel and with no anchor opposite a joint when we don't anchor the joint. Anchors must be put on opposite each other to hold. If you put anchors opposite the joints and there is

*Abstract of a committee report and discussion before the Metropolitan Track Supervisors Club at New York on April 10, 1926.

a chance of creeping you will slew the tie. Before we had a 39-ft. rail, we put six anti-creepers on and that number held the track pretty well.

C. J. Lepperd (Reading): Our latest standard abolishes the slot spikes. The joint plates we are getting now do not have slots cut in them, so of course, we can't spike them, but on old plates that had slots we generally spiked them. One of our troubles has been that usually when we lay rail we don't have the rail anchors on hand and our men slot spike in order to hold the rail until we get the anchors. I think that is one advantage of having angle bars with the slots in them. You don't have to use the slots if you have enough anchors on the rail to hold it, while there is no disadvantage in spiking the slots if you need to, so I favor having bars slotted and using them if necessary.

K. M. Hamman (L. I.): I believe we should eliminate the last part of Conclusion 3. This association should go on record in favor of applying anchors immediately.

P. S. Hurlihe (N. Y., N. H. & H.): I had occasion to lay rail this winter on some badly creeping track and did not put on the anchors for a week or two, but I then found that we had to put them on right away for the rail crept as much as 12 in. in one day.

M. Deniff (Erie): While we do not have very bad conditions, we always apply the anchors as we lay the rail. If we do not have the anchors we defer laying the rail until we get them. Generally we get the rail anchors direct from the manufacturer, but I think that it would be a good idea for a railroad to send the rail anchors to the stores department so that the track supervisor could always call on it for the anchors, and have them on hand when he begins laying rail.

R. H. Orwig (Penna): I agree with Mr. Deniff that it is impossible to get good results if you don't apply the anchors on the same day the rail is laid. You go to the expense and trouble of shimming the rail to get the proper amount of expansion and unless the anchors are applied at once the purpose of shimming is defeated.

On the question of slotted splices, I feel that we can get better results without using the joint tie anchorage plates. The joint is generally known as the weakest point of the track. The rail ends will batter in time, the bolts will get loose, the track will pump and you will have an unsatisfactory condition. When you anchor opposite the joints, and the anchors are doing the work intended, they have a tendency to push the ties and tilt them and you will not get the full benefit of tamping under the joint ties.

Mr. Kerwin (Interborough Rapid Transit): On the Interborough System we find that it is just as essential to apply the anti-creepers as it is to spike the rails. They have to be on when the day's work is finished. We, of course, have a little different problem than steam railroad men.

Mr. Doty: When we said "as soon as possible" we didn't mean a week after, but we meant as soon as the men could get back to apply them, although perhaps we didn't make it clear.

C. L. Connor (Erie): I think we should go on record as saying that the proper time to apply rail anchors is when the rail is laid.

M. C. Martin (N. Y., N. H. & H.): I agree with Mr. Connor that the rail anchors ought to be applied when you lay the rail and not wait until two or three weeks after and go to extra expense.

A. E. Preble (Penna.): I don't see any good reason for putting an insufficient number of rail anchors on if the rail is going to creep. However, if you put a stated number on and find that the rail creeps, then the only reasonble thing to do is to put on enough anchors to hold that rail. I cannot indorse the committee's Conclusion No. 4, that it is better to put an insufficient number on, and let it go at that, than not to put any on at all.

Mr. Kerwin: As to the number of anchors, we have no definite standard. If the rail creeps, we put enough on to hold it, whether it is 3 to a rail or 6 to a panel or 6 to a rail and 12 to a panel. We use as many as necessary, but we don't have to use more than 14 to a panel. We don't use slot spikes on our elevated system; in the subway our old standard provided for the slot holes, but on our new lines the bars are not punched for slot holes.

Mr. Hurlihe: We apply 16 rail anchors to a panel of track. It has been my practice to put one rail anchor opposite the shoulder tie and then distribute them throughout the rail, 8 to the rail, 16 to the panel. In that way I get pretty good results.

Mr. Orwig: I don't feel that the committee can specify any number that should be applied to a rail under the various conditions we have to meet. The grades also affect the number to be applied. At interlocking plants, even on single track, where trains approach stations and apply the brakes, the track will creep more than where the brakes are not applied. I know of one case of a facing switch on a double track where the rail on the right side crept as much as 12 in. every year. I think it is a question of studying conditions and applying anchors as needed.

W. T. Bevan (Penna.): We have anchored the joint ties where we have used slotted spikes and two in each quarter but not on adjoining ties. We get better results by anchoring all the ties in the quarter.

Mr. Lepperd: The best theory that has ever been advanced for rail creeping is that it is due to wave motion. This wave motion is carried throughout the rail so I think the rail anchors ought to be distributed throughout the rail.

C. J. Coon (N. Y. C.): In regard to the economies of anchors, it seems to me that one of the main savings by using anti-creepers has not been touched and that is that we tear our road beds to pieces in spacing ties. If we get away from that by using anti-creepers we certainly can improve the riding qualities of the track and save a large amount of money by not being compelled to space the ties.

F. N. Loughnan (L. V.): The rail anchor in my opinion is one of the most important devices in the maintenance of a railroad. It has revolutionized maintenance of way work. It has made possible the non-spacing of ties in the relaying of rail.

On Big Sandy Line of Norfolk & Western

How Maintenance of Way Work is Done in Northern Africa*

Unusual Methods Are Used on the Sudan Railways to Meet Desert Conditions, Light Construction and the Limitations of Native Labor

By FREDERICK GEORGE AUGUSTUS PINCKNEY

THE SUDAN Government Railways extend throughout the Anglo-Egyptian Sudan, a territory of 1,014,600 square miles, which is of such widely varying characteristics as to impose unusual problems in construction and equally unique and interesting problems of maintenance. Construction was begun in 1876 and the line now represents a system embracing 1717 miles of road.

Beginning at its northern terminus, Halfa, on the Nile, immediately north of the second cataract of that river, where it connects with water transportation, it extends southerly through arid desert land to the fertile upper valley of the river Nile, and the valleys of the White Nile and the Blue Nile.

Physical Conditions and Climate

Traversing a country for the most part arid and sparsely populated, the Sudan railway in two places strikes out over a desert waste where rainfall is practically nil and where shifting sand dunes add to the dangers and difficulties of operation. South of Abu Hamed, where the railroad follows the River Nile and the Blue Nile, the country is less desert like, supporting the growth of low trees and some grass. While rainfall is sparse, ranging from practically nothing at Abu Hamed to 5.67 in. at Khartoum and 18 in. at Sennar, the road crosses numerous dry watercourses, formed by violent local storms which often do much damage to the railroad. West of the White Nile, the railroad extends over undulating country, where the rainfall is more frequent. The Red Sea district around Port Sudan is a bare and rocky country intersected by numerous dry watercourses.

Gradients and Curvature

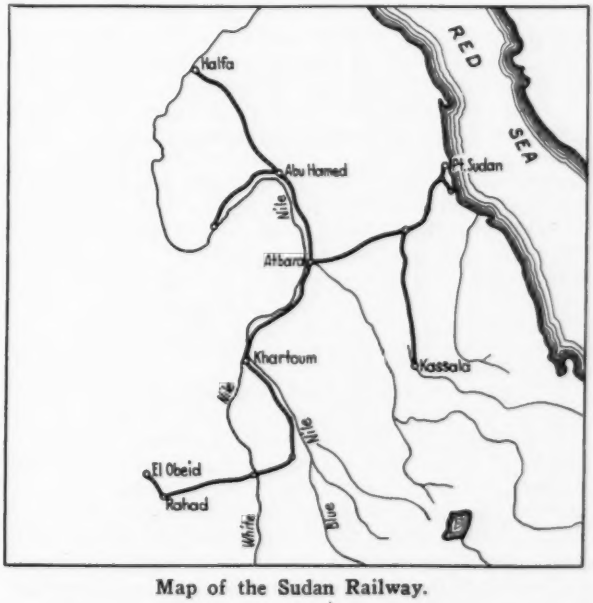
Originally the line from Halfa to Khartoum had a maximum gradient of 0.80 per cent, but this has since been improved to 0.66 per cent. On the Port Sudan line a maximum of 1.00 per cent was allowed up to Summit, with a reduction for curvature. On the Atbara side of Summit, 0.80 per cent is the maximum. All other sections have gradients less than 0.66 per cent. The curvature has been restricted as far as possible to four degrees on the main line, but in a few instances curves up to five degrees have been put in.

In the construction of the Sudan railway, all earthwork was done by hand labor and paid for on a piecework basis, the price varying according to the height of fill, depth of cut, carry, etc. The tools used were baskets, fasses (a native tool like a hoe), and picks. No contractors were employed and all wages were paid direct to each individual laborer. The greater part of the earthwork was done by natives recruited from upper Egypt. These men were brought to the Sudan on a six-month contract, and on the piece-work basis averaged about 10 cu. yd. a day where the earth was loose and did not necessitate picking.

Except where unavoidable, fills were kept to a minimum height, averaging three feet, and rock cutting was avoided where at all possible, even at the expense of longer routes and less favorable alinement and grades. Embankments were made with a 14-ft. crown, the sides taking the angle of repose of the filled material, usually a slope somewhat flatter than 2 to 1.

Track Construction Is Light

Originally the Sudan lines were laid with 50-lb. tee rails except on the Port Sudan side of Summit station, where 75-lb. rails were used. Some of the 50-lb rails were later replaced by 75-lb. rails, the lighter rails being used in the construction of the western branch to El Obeid. For the most part the 50-lb. rails have



Map of the Sudan Railway.

now been in service for over 20 years, while approximately 250 track miles of the rails have been in service more than 25 years. With the exception of those at stations, little wear is evident on any of the rails, but as a result of washouts and soft banks a large number of rails have been distorted and removed. Both the 50-lb. and 75-lb. rails laid originally were 30 ft. in length. However, recent replacements of 75-lb. rails have been 36 ft. long.

The gage of the Sudan railway is 3 ft. 6 in. throughout, the rails being laid with staggered joints on either creosoted white wood ties with tie plates or on steel ties. Twelve ties are used to the 30-ft. rail and 14 to the 36-ft. rail. Slightly less than one-third of the lines

*Abstracted and rewritten from a paper published by The Institution of Civil Engineers, London, England.

are laid with steel ties, these having proved satisfactory in the arid sections of the country. In general, however, wooden ties are preferred, it having been found that at best only an inferior track can be maintained on the steel ties under fast traffic.

With practically no available timber in the country suitable for ties, extended experiments were made with soft white wood, jarrah, mahogany, and other tropical woods, the white wood when thoroughly creosoted and protected by tie plates, proving the most satisfactory and economical. The size of the ties used up to recent years, has been 5 in. by 9 in. by 7½ ft. These, however, proved too long, in that they bent up at the ends and broke in the center in many cases, so that ties 4½ in. by 8 in. by 6½ ft. are now being used.

While earth is used throughout for sub-ballast, and for building a section well up under the rails and over the ties, stone was tried for filling in the cribs without much success as it allowed rain to penetrate the bearing surface under the ties and did not afford the ties as much protection against the heat of the sun as did the earth. For these reasons and because of the frequent loss of large quantities of ballast through washouts and shifting sand-dunes, the use of stone has been practically abandoned.

Unusual Track Maintenance Methods

With a total of 1,717 miles of line, there are 1,875 miles of track to be maintained. This is done by section gangs living at the stations along the line who are provided with hand cars with which to get over their territories. Each gang is under direct charge of a native foreman, who can maintain the track in good condition under ordinary circumstances. More experienced foremen are generally in charge of two or three sections. These men were mostly Egyptian in the past, but natives of the Sudan are now being gradually educated to the work and prove very efficient. Each district has a British supervisor, or permanent-way inspector, as he is called, who is under the direction of a British engineer. The system is divided into eight districts of an average length of 270 miles, grouped into two divisions. The distribution of the maintenance staff is as follows:

1 District Engineer to 270 track miles.
1 Permanent Way Inspector to 160 track miles.
1 Mason to 59 track miles.
1 Carpenter to 229 track miles.
1 Native Track Foreman to 11 track miles.
1 Native Track Laborer to 1.14 track miles.

The relaying of 50-lb. rails on the Atbara-Khartoum line with 75-lb. rails was carried out in an unusual manner, it being deemed the most practical however, in view of the advisability of replacing most of the ties. The old 50-lb. track was unjointed, lifted with jacks, and then thrown out in rail lengths by hand to the side of the line. The new track material, having been already distributed along the side of the old track and assembled, was lifted in place by rail lengths and tamped, the filling in and dressing up of the ballast sections being left for a following gang. Another gang disconnected the old track, reclaiming all usable material.

The complete renewal work was carried out by a large force, approximating a track construction organization, a mile or more of track being completely relaid in a day. On some sections of the line the day's work was completed between trains. However, when interruptions by traffic occurred, little delay was experienced as the old track was not thrown out until the new track was ready to be put in place.

When the original lines were built, only the bridges obviously necessary were put in over well defined watercourses, supplemented by numerous cast iron pipe culverts two feet in diameter. Subsequently, a large number of bridges and culverts have been put in and many of the small culverts renewed with larger pipes, or replaced with 15-ft. span bridges.

The common spans in use on the Sudan are 105 ft., 55 ft., 26 ft., 16 ft., 15ft., 10 ft., and 6 ft. Still smaller spans have also been used in some instances, these being made of concrete slabs reinforced by old rails. A 15-ft. girder culvert is the standard on the system and is used wherever possible, the number of spans being varied to suit each case. There are only four large bridges.

Abutments, piers and culvert pipe head walls are generally of granite rubble masonry set in Portland cement. In all of these structures plain standard designs have been used because of an insufficient engineering staff to draw up individual plans.

Stations and Buildings

Owing to the industrial conditions prevailing throughout the Sudan and the general climatic conditions, extensive station layouts and large and elaborate station buildings are not necessary. For the most part, the track facilities at wayside stations consist of a passing track and an industry track. At many stations the industry tracks are equipped with a loading ramp and sometimes a small stock pen.

Various materials have been used for station buildings, such as canvas, mud-brick, stone and modern clay brick. Box cars and round grass thatched huts are also used to some extent.

One of the greatest problems on the Sudan railway is that of securing a sufficient and suitable water supply, an excess occurring during rains and a shortage during the dry season. Where the line runs near the river, a good supply has always been available, but where wells have been drilled the supply has been scarce and as a rule of very poor quality, for both drinking and boiler purposes. In order to store the available water supply at the larger stations, 50,000-gal. cast iron overhead storage tanks have been installed, while at the smaller stations a series of 1,500-gal. cast iron overhead storage tanks are used.

An Arch Fire-Brick on the Rail Causes Derailment

TRAVELING at a moderate rate of speed on a well maintained piece of track, a passenger train on the Pennsylvania was derailed at Kladder, Pa., at 4:57 p. m. on March 3, 1926. As a result of the accident the engineman and a bystander were killed and eight passengers, one employee and one other person were injured. Complete evidence clearly showed that both the track and equipment were in good condition prior to the accident and indicated that it was caused by a locomotive fire-box arch brick which had fouled the track.

The derailment occurred on a six-degree curve directly opposite the center of a string of five cars standing on a spur serving the station of Kladder. Some time prior to the accident cinders had been unloaded from the center car of this string and evidently an arch fire-brick in the cinders had fallen from the car, fouling the main track, without attracting attention. While some doubt was experienced at first, regarding the cause of the derailment, conclusive evidence laid the responsibility to the carelessness of the persons unloading the cinders.

The Northbound Hump of the Illinois Central's Markham Yard After the Storm of March 30.

Fighting the Spring Blizzard In the Chicago Terminals

Use of Locomotive Blowers and Daily Payments of Extra Men Distinctive Features of Methods Pursued by the Railroads

ON MARCH 30 a severe blizzard visited the area to the west and south of Lake Michigan and extended as far southwest as Oklahoma which was in many ways of an unusual character. Its severity, duration and resulting depth of snow were almost without precedent for the season. Eleven inches of snow fell at Chicago on Wednesday, March 30, with additional falls during the remaining days of the week to an aggregate depth of about 15 in. But what is more unusual is the fact that more delays to trains were reported by roads entering Chicago from the southwest than from those entering over lines from the northwest and north of the city. The snow was wet and exceedingly heavy. Fortunately the temperature remained above freezing for nearly the entire duration of the storm, there being only one night when it descended to a level that threatened trouble from frozen sleet.

Except for the difficulties reported in isolated outlying points where snow filled cuts that had to be cleared before train service could be resumed, the greatest burden imposed on the railroads by the storm was experienced in the Chicago terminals, where several thousand extra men had to be employed to reinforce the regular railway organizations, including not only the maintenance of way men but also large numbers from the mechanical and freighthouse forces. The manner in which the situation was met and overcome formed the subject for discussion at a meeting of the Maintenance of Way Club of Chicago on Wednesday evening, April 21. Brief talks on the manner in which the work of fighting the storm was organized and handled were given by E. D. Swift, engineer maintenance of way, Belt Railway of Chicago; Emil Rost, supervisor, Baltimore & Ohio Chicago Terminal; T. Thompson, roadmaster, Atchison Topeka & Santa Fe; Charles Ettinger, supervisor of bridges and buildings, Illinois Central; H. P. Savage, engineer of track, Chicago Rapid Transit, and R. L. Sims, roadmaster, Chicago, Burlington & Quincy.

Large Snow Fighting Force Required

Most of the speakers reported that the organization required to keep the lines open and the yards cleared during the course of the storm greatly exceeded the regular and extra gang forces employed in routine maintenance of way work, but the discussion brought out clearly that practices varied widely as to the manner in which forces were amplified to meet the storm conditions. The Illinois Central, the Belt Railway of Chicago and the Chicago & North Western recruited extra men from local labor agencies, the Illinois Central and the North Western each employing as many as 500 additional men. The Burlington depended entirely on such increase in the force as could be effected by calling on car repairers and freighthouse employees for storm duty, this practice being followed in part also by the Belt Railway of Chicago. Mr. Thompson of the Santa Fe reported unsatisfactory experience with casual labor and stated that he was able to meet the storm conditions satisfactorily by amplifying the terminal track forces from the section gangs at outlying stations. The most complete utilization of forces available from other departments was reported by Mr. Savage of the Chicago Rapid Transit system, who explained that the peculiar conditions imposed on this line, which has 165 miles of railway track on elevated structures and 62 miles of line on ballast, were such that men unfamiliar with conditions on that property are of little value. For this reason a plan of organization has been perfected on that system whereby it was possible to increase the regular maintenance of way force of 550 men by 750 men from the mechanical and train service departments, men of the latter

class thus employed being primarily those on the extra list. The effective utilization of such a large force, he said, was practicable only through the perfection of a detailed plan of organization providing for the definite assignment of the men over the entire system. Through this means it was possible not only to keep 227 miles of track in condition for uninterrupted service but to insure also the cleaning of 17 miles of platforms and hundreds of stairways to the elevated stations.

Thorough Plan of Organization is Essential

Mr. Swift stated that the Belt Railway maintenance of way department holds a "snow meeting" in the fall for the purpose of developing an effective snow fighting force. At this meeting steps are taken to ascer-

Form 708 C. & N. W.

Galena DIVISION

R. 9788 500 Blks. 11-2

DAILY TIME REPORT EXTRA GANGS

Date April 1- 1926 Location Randolph Street

(Indicate Rate of Pay in Remarks)

NAME	NUMBER	7 A M	10 A M	1 P M	3 P M	4 P M	M	HOURS WORKED	
Smith, John	1	✓	✓	✓		✓		8	.76
Irving, James	2	✓	✓	✓		✓		8	
Miller, Frank	3	✓	✓	✓	✓			7	
Hurst, Fred	4	✓	✓	✓		✓		8	
Pack, Walter	5	✓	✓	✓		✓		8	
Bartal, Andrew	6	✓	✓	✓		✓		8	
Finlen, Thos.	7	✓	✓	✓	✓			7	
Fritz, Mike	8	✓	✓	✓		✓		8	
Hall, Peter	9	✓	✓	✓		✓		8	
Borcek, Louis	10	✓	✓	✓		✓		8	
Danesy, John	11	✓	✓	✓		✓		8	
Dembo, Chas.	12	✓	✓	✓		✓		8	
Bazonski, Mike	13	✓	✓	✓	✓			7	
Kobeck, Mike	14	✓	✓	✓		✓		8	
Kelly, Geo	15	✓	✓	✓		✓		8	
New, Cam.	16	✓	✓	✓		✓		8	
Patrick, Geo.	17	✓	✓	✓		✓		8	
Morley, Steve.	18	✓	✓	✓		✓		8	
Jarosh, John	19	✓	✓	✓		✓		8	
Mest, Geo.	20	✓	✓	✓	✓			7	
Vancele, Aaron	21	✓	✓	✓		✓		8	
Button, Mike	22	✓	✓	✓		✓		8	
TOTAL NO. OF MEN		TOTAL NO. HRS.							

The word "Quit" should be marked after the hours allowed men to whom "Quit Work Slip" have been issued.

Correct: John Murphy Foreman.

Signed: Arthur Anderson Timekeeper.

A Specimen of the Timekeepers' Daily Report.

tain the number of men that can be recruited from other departments, the number of additional men that can be utilized as foremen during storms, as well as the clerks that can be called on to serve as timekeepers, labor dispatchers and commissary clerks to make arrangements for the feeding of the men during the storm.

The method of dispatching the men to the work presents a particular problem on the Belt Railway of Chicago owing to the fact that the most important unit of the property, Clearing yard, is located about 14 miles from the centers of labor supply. Men employed during the daylight hours are recruited the night before and assembled as far as possible in lodging houses where they may be called at four o'clock in the morning and sent out on work trains. These trains are equipped with mess cars so that breakfast can be served to the men while they are traveling to the various locations to which they are assigned over the terminal property. Others of the speakers stressed the matter of feeding the men, and the consensus of opinion favored taking them to restaurants in the vicinity of the work as the most practicable means of meeting this requirement during an emergency condition.

As pointed out by Mr. Swift, snowfall in Chicago is rarely heavy enough to give rise to the employment of plows or spreaders in snow removal. In fact, snow is almost never a source of difficulty on unbroken track. The real problem lies in keeping switches and interlocking plants in condition for operation. Therefore the first essential is to provide men with brooms and shovels to keep these critical portions of the track clear. Mr. Sims reported that the Burlington maintained a stock of 500 brooms and 300 snow shovels in readiness for use in snow storms on the Terminal division. Mr. Thompson said that he was able to amplify the work of the regular maintenance forces by furnishing each switch crew with a broom and by assigning a trackman with a broom to every switch engine so that he could clean out any snow blocked switches which the engine needed to use.

Use Locomotives Equipped with Blower

The most outstanding development brought out in the discussion was the extensive use made by the railroads in the Chicago terminals of locomotives equipped with steam blowers. Mr. Rost reported that he was able to keep two large yards in the Calumet district in operation with almost no increase in the regular force through the employment of two locomotives with blowers. These engines passed over the ladder tracks at sufficiently frequent intervals to keep the switches clean, the speed of the engine while in this service and the number of trips depending on the rate of snow fall. In general it was found possible to operate the switches during the storm for about an hour after they had been cleaned in this manner. The blowers used on the various railroads differ somewhat in design but in general they provide for the jetting of steam on each side of each rail in such a manner that the snow is blown out by the steam pressure.

As explained by Mr. Swift, this device is in no sense a snow-melter but a "snow-blower," and when properly adjusted is effective in cleaning out the snow to the tops of the ties. In some cases the valves controlling these snow blowers are operated from the fireman's side of the engine, but in other cases the valves are placed on the side of the boiler near the front end and according to M. D. Carothers of the Baltimore & Ohio Chicago Terminal this arrangement is superior since it enables the operator to obtain a better view of the work.

Daily Payment of Extra Men

One fact brought out in the discussion which excited particular interest was the practice followed by two railroads of paying off the extra men each day, this plan having been adopted because it greatly simplifies the recruiting of casual labor and makes it possible to secure men at a lower rate. Because of the effectiveness of the plan, its simplicity and the results obtained, the system in vogue on the Chicago & North Western is described below in detail.

The Chicago & North Western maintains a division accounting system under the direction of a division accountant who is attached to the division superintendent's staff but reports to the auditor of disbursements. His office handles all time and material reports for the division and in addition the division auditor for the Galena and Wisconsin divisions, whose headquarters are at Chicago, has charge of the maintenance of way timekeepers in the Chicago terminal area.

Whenever an emergency arises such as a snow storm he is notified as to the approximate number of extra men to be employed and makes arrangements for the employment of such additional timekeepers as he deems necessary under the conditions. To avoid a disruption of the regular accounting organization which must maintain its maximum efficiency at such times, he recruits the extra timekeepers from outside the organization. Many of these are college men and others who have been employed as timekeepers during summer vacation periods and are glad to obtain temporary employment during such emergencies. Most of these men are familiar with the duties imposed upon them but to avoid any possibility of misunderstanding, explicit printed instructions are given them, explaining just how the work is handled.

As soon as a gang is sent out from a labor agency the division accountant is notified and he assigns an inspector to the gang who goes out to the location to which this particular gang has been assigned. Arrangements made early in the fall designate specific headquarters for each snow-fighting gang with arrangements to use some yard office, freighthouse, interlocking tower, etc., as a contact point to afford telephone communication between the foreman or the timekeeper and division headquarters.

As soon as the timekeeper reaches the gang he fills out a daily time report, using the regular form provided for extra gang work. On this form he enters the name of each man and assigns him a number, giving each man a button with the corresponding number, to be worn in plain sight on his coat. Then in the first column, marked "M" on this sheet, he notes the time the gang started to work and makes a check opposite the name of each man. This detail having been completed, he makes out identification cards for each man, this card showing the man's name, his occupation and number, the date and place employed or gang location. If any man cannot write his name the timekeeper enters a description of the man in a form provided for this purpose on the back of the card.

Each timekeeper is required to remain with the gang during the entire tour of service and at intervals of two or three hours he passes through the gang to make a check of the men at work. Each time he makes a check he makes use of another of the "M" columns in the time report, noting the time of day and then making a check mark in the column opposite each man's name.

Finally when the gang quits he makes a final check in the last "M" column, noting the exact quitting time. Then, but not until then, he gives each man his identification card, which has been signed previously by the foreman, this card being the means of identifying the man at the paymaster's office. As each man is handed a card he is told where and at what time he will be paid. In general a gang laid off at any time up to midnight is paid at nine o'clock the following morning.

Just as soon as a gang is released the timekeeper goes to the division accountant's office, where he turns in the time report, which he has completed in the meantime by entering the total hours worked by each man, the rate of pay, the date, gang location, etc., the report being signed by both the foreman and the timekeeper. At the division accountant's office this time report serves as the basis for the payroll, which is made out immediately on the forms regularly used for the semi-monthly payroll for extra gang labor.

Form 807-C R-3671 2-10-25 20M sets of 3 (18379) GAL. DIV. PAY ROLL #66 EXTRA SNOW GANG PAY SHEET #108 SEC. 3 APRIL 1, 1926.

CHICAGO AND NORTH WESTERN RAILWAY COMPANY

Semi-Monthly Pay Roll for Employes named below for the second period of the Month of ..... 19..

Page No. .....

Working No.	NAME	Place where check will reach payee	Pos. and Rptg. Nos.	OCCUPATION	Straight Time		Punitive Overtime		Other Time		Amt. earned First Period	Amt. earned Second Period	Deductions	Balance	PAID BY CHECK NUMBER (If paid by Time Ticket, show Number)
	EXTRA LABORERS - WELLS ST.				Time	Rate	Hours	Rate	Hours	Rate					
1	Smith John	Randolph St.			9H	.76					6 08				
2	Irving James				8H						6 08				
3	Miller Frank				7H						5 32				
4	Hurst Fred				8H						6 08				
5	Pack Walter				8H						6 08				
6	Bertel Andrew				8H						6 08				
17	Patrick Geo.				8H						6 08				
18	Morley Steve				8H						6 08				
19	Jarosz John				8H						6 08				
20	West Geo.				7H						5 32				
21	Vancele Aaron				8H						6 08				
22	Button Mike				8H						6 08				

Specimen of Payroll Used for Daily Payment of Extra Snow Gangs.

This payroll is made out in triplicate; the first sheet goes to the auditor of disbursements, the second is the pay sheet and is sent to the paymaster and the third is retained by the division accountant for his records. The pay sheet is countersigned by the division accountant and the division superintendent before it is sent to the paymaster. When the men arrive at the paymaster's office they are paid off by gangs. A special officer assigned to the paymaster's office assembles the men in gangs and also in the order of their numbers, so that all men present appear at the pay window in the order in which their names appear on the roll, and as they are paid their identification cards are taken up.

Among the advantages which have been demonstrated through the use of this system are: greater ease in the recruiting of extra labor, expedition, accuracy, elimination of fraud and a notable absence of controversy with the men as to the amount of pay which is due them. The division superintendent determines the rate to be paid and advises the division accountant and the labor agent of his decision so that there can be no misunderstanding as to the established

rate on the part of any one concerned. The division accountant gives this information to the timekeepers so that if any man has any question as to the rate he is to be paid he is afforded opportunity to obtain a clear understanding by questioning the timekeeper on the job. The presence of the timekeeper also assures that each man knows exactly how much time he has been allowed by the timekeeper for his work as it is common practice for the men to ask the timekeeper the number of hours allowed when the identification cards are given out. As a further means of avoiding misunderstanding, the timekeepers are required to be present when their men are paid and can quickly put an end to any dispute at the paymaster's window. As a result there have been practically no controversies, notwithstanding the fact that as many as 500 extra men have been paid off in a single day.

This plan assures against fraud as a man is not given his identification ticket until the gang is dismissed or until he quits. When any man leaves the gang before the regular quitting time, the time that he quits is noted in the time report before he is given his identification card.

The plan also assures advance information to the paymaster as to the number of men he will be required to pay and the amount of money he will need. This is made possible by having the timekeepers call up at intervals during the tour of duty, advising as to the number of men and the approximate total amount that will be due the gang at the end of the working period.

An illustration of the effectiveness and flexibility of the plan is afforded by the manner in which the railway was able to meet a situation which arose on April 3, the Saturday before Easter Sunday. For some reason the labor agencies were confronted that morning with a general demand for a rate of one dollar an hour for this Saturday's work. But when the railroad advised the agencies that it would pay all men employed on Saturday, immediately after quitting time it was possible to hire all the men necessary at a rate of 57 cents. To carry out this plan effectively the division accountant instructed the timekeeper to report to him by telephone early in the afternoon as to the number of men at work and the approximate amount of money required for each gang so that this information could be transmitted to the paymaster before the close of banking hours. When the gangs quit at five o'clock the timekeepers reported at once at the division accountants office, the payrolls were made up and sent to the paymaster and by 7:30 p. m. the last man had received his money. Some of the men were paid within an hour of quitting time.

We are indebted for the above information concerning the plan followed by the Chicago & North Western to W. G. Burns, division accountant, Galena and Wisconsin divisions.

Improvements in Track Material Cut Maintenance Costs

THE INFLUENCE of the quality of track material on maintenance costs is strikingly illustrated in results obtained by the Indianapolis Union Railway following the laying of heavier rail and improvements in other track material. Over a period embracing 12 years, from 1914 to 1925 inclusive, the man hours expended for maintenance per mile of track per annum for its freight lines decreased from 3,525 to 2,103, or 40 per cent, while on the passenger lines there was a much larger decrease.

The tracks operated by the Indianapolis Union Railway comprise two divisions of radically different conditions of service. The Belt Railroad division comprises 14.18 miles of main track, 11.54 miles of second main track and 37.63 miles of sidings, or a total of 63.35 miles, which is used exclusively for freight traffic. The Union Tracks division consists of 1.77 miles of first main track, 1.76 miles of second main track, 1.35 miles of other main track and 9.38 miles of siding, or a total of 14.26 miles, and handles passenger traffic only, with the exception of such switching as is required by the industrial tracks connecting with it.

The hours of labor required per mile of track for each division for the year 1914 to 1925 inclusive are shown in the table with the exception of the years 1916 to 1920 inclusive for the Union tracks, during which period these tracks were elevated and entirely rebuilt owing to the construction of the new Union Station. The records of labor used in track maintenance prior to 1914 are so incomplete that it is impossible to make a comparison with years previous to that time.

The Belt Railroad division forms an almost complete circuit of Indianapolis with a radius of approximately 2½ miles and connects with all the railroads entering the city. Its function is to handle interchange freight traffic between the various carriers and to furnish switching service to the industries connecting with this line. In addition, its tracks are used by all roads having two or more divisions connected with the Belt Railroad for handling freight traffic between these divisions with their own power. Its traffic density is high, an average of 1,400,000 cars being handled annually.

Year.	Belt Railroad		Union Tracks	
	Mileage of tracks maintained.	Man hours of track maintenance per mile of track.	Mileage of tracks maintained.	Man hours of track maintenance per mile of track.
1914	61.92	3,525	6.33	9,851
1915	61.63	3,170	6.30	12,168
1916	62.50	2,642	.....	.....
1917	62.59	2,637	.....	.....
1918	63.78	2,501	.....	.....
1919	63.82	2,444	.....	.....
1920	64.01	2,399	.....	.....
1921	63.76	2,355	12.36	1,942
1922	63.59	2,186	13.46	2,782
1923	63.63	2,349	14.26	4,369
1924	63.64	1,945	14.26	2,916
1925	63.35	2,103	14.26	3,148

Reconstruct Belt Tracks in 1918

During the period from 1909 to 1912, inclusive, a portion of the Belt Railroad was elevated and in connection with this work more than 9 miles of track was rebuilt with new 85-lb. rail, ties and ballast except that some relaying 85-lb. rail was used in some of the less important tracks. On the completion of

this work, the rail in all of the tracks of the Belt Railroad was either 85-lb. or 70-lb. section, all of the tracks subject to heavy traffic being laid with 85-lb. rail. After the completion of this elevation work in 1912, there was little change in the character of the material in these tracks until 1918, when the first 100-lb. rail was laid. Since that time about 21 miles of 100-lb. rail has been laid on tracks subject to heavy traffic, and most of the 70-lb. rail has been replaced with 85-lb. rail. Improvements were also made in the quality of the other track materials. The use of treated ties was not begun until 1924, so that up to this time there has been no reduction of labor in tie renewals on that account.

The Union tracks division comprises the approaches to the Union Station, together with the necessary station tracks, coach tracks and sidings, and four industrial spurs. The Union Station is used by all of the passenger trains of all the steam roads entering Indianapolis and no freight traffic is handled over these tracks except in emergencies and for serving the industries connected therewith.

Union Tracks Rebuilt to Heavier Construction

The new Union Station was built in the years 1916 to 1920, inclusive, and in connection therewith the Union tracks were elevated and entirely reconstructed with 100-lb. rail, No. 5 ties and stone ballast, except that the part of the coach tracks beyond the ladder track (about 1.3 miles of track) were constructed of 85-lb. rail, No. 4 ties and cinder ballast. Prior to this work, the Union tracks were constructed of 85-lb. rail except the coach tracks, which were laid with 70-lb. rail. The ties were small and the ballast was of poor quality. Since much of the labor due to the change of tracks and other work incidental to the elevation and reconstruction of the tracks was of necessity charged to maintenance, the records for these years give no indication of normal maintenance costs and are consequently omitted from the tabulation.

The gradual decrease in the labor charges on the Belt Railroad tracks and the large decrease in such charges on the Union tracks since their reconstruction show plainly the effect of the improvements in track material to render them adequate to the service imposed. It should be recalled that about 9 miles of the Belt tracks had been rehabilitated with 85-lb. rail, new ties and new ballast just prior to 1914, so that the reductions in labor after the laying of the 100-lb. rail stand out all the more prominently.

These reductions have been accomplished under the supervision of T. R. Ratcliff, engineer maintenance of way.

Rail Production In 1925 An Increase Over 1924

AN INCREASE in the tonnage of rails rolled and a marked increase in the tonnage of rails weighing 100 lb. per yd. and over are shown in the statistics for rails rolled in the United States during 1925, prepared by the American Iron and Steel Institute. As indicated in the following table the production during 1925 totaled 2,785,257 tons, or 351,925 tons more than the total for 1924. Production during 1925 not only exceeded that for 1924, but with the exception of 1923, when the total reached 2,904,516 tons, it was greater than for any year since 1917.

The production of Bessemer rail was practically negligible, being only 9,687 tons, which is 6,382 tons less than the small amount rolled in 1924. This new minimum represents but 0.35 per cent of the total tonnage of rails produced in 1925 and was made up almost entirely of small sections as only 0.02 per cent of the tonnage of rails weighing 85 lb. per yd. and over was rolled from Bessemer steel.

Production of Rails by Processes, Gross Tons, 1910-1925

Years	Open-hearth	Bessemer	Rerolled*	Electric	Iron	Total
1910	1,751,359	1,884,442	.....	†	230	3,636,031
1911	1,676,923	1,053,420	91,751	462	234	2,822,790
1912	2,105,144	1,099,926	119,390	3,455	.....	3,327,915
1913	2,527,710	817,591	155,043	2,436	.....	3,502,780
1914	1,525,851	323,897	95,169	178	.....	1,945,095
1915	1,775,168	326,952	102,083	.....	.....	2,204,203
1916	2,269,600	440,092	144,826	.....	.....	2,854,518
1917	2,292,197	533,325	118,639	.....	.....	2,944,161
1918	1,945,443	494,193	101,256	.....	.....	2,540,892
1919	1,893,250	214,121	96,422	50	.....	2,203,843
1920	2,334,222	142,899	126,698	297	.....	2,604,116
1921	2,027,215	55,559	96,039	5	.....	2,178,818
1922	2,033,000	22,317	116,459	.....	.....	2,171,776
1923	2,738,779	25,877	139,742	118	.....	2,904,516
1924	2,307,533	16,069	109,730	.....	.....	2,433,332
1925	2,691,823	9,687	83,747	.....	.....	2,785,257

*Rerolled from old steel rails. Included with Bessemer and open-hearth steel rails in 1910. †Small tonnage rolled in 1910, but included with Bessemer and open hearth rails for that year.

Production of Rails Showing Increase or Decrease by Processes, Gross Tons, 1924-1925

Kinds	1924	Per cent	1925	Per cent	Increase	Per cent
Open-hearth	2,307,533	94.83	2,691,823	96.64	384,290	16.65
Bessemer	16,069	.66	9,687	.35	*6,382	*39.72
All other	109,730	4.51	83,747	3.01	*25,983	*23.68
Total	2,433,332	100.00	2,785,257	100.00	351,925	14.46

*Decrease.

Another point of interest is the decrease in the quantity of old rails re-rolled, 83,747 tons, an amount smaller than that for any other year recorded in the table.

Exceeding that of any previous year, the production of rail weighing 100 lb. per yd. and over during 1925, reached a total of 1,636,631 tons, an amount which evidences the general trend toward the increased use of heavier rail sections. According to this figure, the production of 100-lb. rail and over, represents 58.7 per cent of the total tonnage rolled.

Production of Rails by Weight Per Yard, 1908-1925

Years	Under 45 pounds	45 and less than 85	85 and less than 100	100 pounds and over	Total gross tons
1908	183,869	687,632	1,049,514		1,921,015
1909	255,726	1,024,856	1,743,263		3,023,845
1910	260,709	1,275,339	2,099,983		3,636,031
1911	218,758	1,067,696	1,536,336		2,822,790
1912	248,672	1,118,592	1,960,651		3,327,915
1913	*270,405	†967,313	2,265,062		3,502,780
1914	*238,423	†309,865	868,104	528,703	1,945,095
1915	*254,101	†518,291	742,816	688,995	2,204,203
1916	*295,535	†566,791	1,225,341	766,851	2,854,518
1917	*308,258	†882,673	989,704	763,526	2,944,161
1918	*395,124	†665,165	888,141	592,462	2,540,892
1919	*263,803	†495,577	965,571	478,892	2,203,843
1920	*489,043	†433,333	952,622	729,118	2,604,116
1921	*211,568	†214,936	902,748	849,566	2,178,818
1922	*265,541	†274,731	728,604	902,900	2,171,776
1923	*272,794	†300,907	864,965	1,465,850	2,904,516
1924	*191,046	†213,274	853,431	1,175,581	2,433,332
1925	*163,607	†219,648	765,371	1,636,631	2,785,257

*Includes rails under 50 pounds. †Includes 50 pounds and less than 85 pounds.

A further indication of the increased use of heavier rail is evidenced by the decrease in the production of rails weighing 85 lb. per yd., and less than 100 lb., this amounting to only 765,371 tons, which with the exception of 1922, when it dropped to 728,604 tons, is the smallest amount produced since 1915. Rails of these weights produced during 1925 represent less than one-half of the production of rails weighing 100 lb. per yd. and over.

Culvert Pipe 105 ft. Long Is Jacked Through 47-ft. Fill*

Because of Width of Embankment It Was Necessary to Push Pipe in From Both Sides of Embankment

By E. J. CULLEN
Division Engineer, Lehigh Valley, Auburn, N. Y.

UNDISTURBED traffic and roadbed and completion at one-third of the estimated cost of using falsework and open excavation were the outstanding features of a recent culvert installation on the Lehigh Valley. An outlet in a high ravine fill on the Elmira and Cortland branch of the Auburn division near Varna, N. Y., had several times caused considerable concern when water overtaxed the capacity of the culvert during spring freshets. The estimated cost of driving falsework and excavating to install a larger pipe was prohibitive on account of the height of the fill, 47 ft. Consequently the plan of jacking a new pipe of adequate size through the embankment was studied and finally adopted. The length of 105 ft. of pipe to be jacked made the outcome of the project of considerable technical interest.

The old opening was a 12-in. pipe. It was decided to replace this pipe with a 42-in., 10-gage corrugated pipe which was known to be strong enough to resist the pressure of the jacks and of sufficient strength and flexibility to sustain the embankment load when in place. This is the minimum size of pipe through which excavation could be carried on conveniently. The pipe was delivered in 20-ft. lengths except the sections at each end, which were made in lengths to fit the approach trenches after the job was well under way. The sections were delivered on the site and unloaded directly from the cars to a position where they could be rolled into place with a minimum of labor.

Dig Approach Trenches

The supervisor of bridges, with a foreman and six men, started the approach trenches at the culvert location on the downstream side of the embankment, to insure good drainage during construction. The plan was to trench back into the fill to the point where tunneling would be more economical, or practically to the point where the rate of progress by jacking would exceed the rate by digging.

A lining trough was constructed by embedding three 8-in. by 16-in. timbers 27 ft. long in the bottom of the trench, which extended back to the jack supports. The sides of the trough consisted of 6-in. by 8-in. pieces. These timbers were much heavier than would ordinarily be used for this purpose, but the unstable condition of the ground made this extra precaution advisable, as it was imperative that the pipe be kept as nearly as possible on line and grade as it passed through the fill.

The supports for the jacks consisted of a 12-in. by 12-in. timber frame set in the ground with additional 8-in. by 16-in. pieces for anchorage some distance down the slope. It was necessary that the jack supports be built of heavy timber and as close to the ground as possible under the conditions and additional anchorage placed behind these supports to resist the enormous pressure developed.

The Jacking Operation

The pipe was rolled down the slope by four men with a rope that was anchored to the rail, passed around the pipe and snubbed around a tie. In this manner the pipe was carefully let down into the trench and accurately placed on the lining timbers. A bearing frame, constructed of secondhand 8-in. by 8-in. bridge timbers, was placed over the end of the pipe to distribute the jack pressure evenly over its periphery. The frame had an opening large enough to pass a man with a wheelbarrow. A one-inch iron hoop was tightened in the first corrugation from the end of the pipe to stiffen it. The jacking blocks were located along either side of the lining trough and the wheelbarrow runways placed to lead out between the blocks to a platform over the jacks. A plank was also placed in the bottom of the pipe to protect the galvanizing and make wheeling easier. The jacks were tightened up and actual jacking began, averaging about one foot an hour the first day. The crew of six men was divided for the work as follows: Two men digging ahead inside the pipe, one man wheeling the excavated material out through the pipe, one man assisting the barrow up the runway and out to the dump, and two men operating the jacks. The men changed places frequently as digging in cramped quarters was a strenuous operation and the speed of the work depended on the rate of digging inside the pipe.

The fill was found to consist of various kinds of material, the grade apparently having been raised considerably at different times. The first 40 ft. was through a sticky blue clay, followed by pockets of quicksand and several large boulders were encountered.

Two 50-ton jacks having a reach of about two feet were used. At first these were of ample power, but when the pipe had extended about 70 ft. into the fill jacking became exceedingly difficult. Three men were required on each jack until 80 ft. was reached and after the pipe had set over night it refused to move any farther. This was probably caused by the fill settling slightly. After attempting several times to move the pipe by using the full force of the jacks, the pipe end was reblocked and two 25-ton jacks added, making a total available jack capacity of 150 tons. The pressure exerted was so great that the 18-ft. length of pipe exposed was shortened three inches, springing back to its original length when pressure was released. The pipe began to show signs of strain at the first joint, so it was decided to complete the culvert by jacking from the opposite side of the embankment.

The major hazard of completing the job from the other end was the difficulty of driving the two ends so they would meet inside the embankment. First the

*The methods described in this article are similar to those covered in the article by W. C. Swartout which appeared in *Railway Engineering and Maintenance* for March 1926, page 101, but the project described by Mr. Cullen imposed difficulties not encountered in the other work, and which imposed the development of a variation in the method which the reader will find of unusual interest.

location and elevation of the inside end of the installed pipe was carefully determined and found to be on almost perfect alignment but slightly below grade. The situation was corrected by designing the remainder of the culvert at a slightly lower gradient. This permitted locating the lower end as originally contemplated.

8-in. by 16-in. timbers, 8 ft. long, were placed horizontally in this trench. One heavy timber was placed on and against these timbers and securely braced to receive the thrust of the jack. One 50-ton jack proved of ample power. The bearing block against the end of the pipe was built without an opening and the thrust

Jacking a Culvert Pipe Through a 47-ft. Embankment

(1 and 2) Two Views of the Jacks and Jacking Rig, (3) The Bearing Frame Against the End of the Pipe and Entrance to the Pipe, (4) Armco Pipe Being Lowered into Place With a Snubbing Rope, (5) Behind the Bearing Frame the Pipe was Reinforced with a Heavy Steel Hoop, (6) The Upstream Trench was Heavily Shored and Braced.

The upstream approach trench was started and it was planned to extend the excavation until the trench was 17 ft. deep, but quicksand was encountered at a ditch depth of 8 ft. and it was necessary to timber the ditch to complete the work of excavation.

The accuracy with which the two pipe ends would meet depended entirely on the careful alinement of the lining timbers. These were placed as before. In constructing the new jack support, a trench was excavated at right angles to the center line of the culvert. Two transmitted by one line of timbers. The excavation averaged five feet per day at this end.

The pipe was jacked to within eight inches of the other end of the pipe and was found to be in good alinement and grade with the section of pipe first installed. An opening was excavated about six inches larger than the outside of the pipe. The ends of the pipe were strongly wired together so that the wiring would act as reinforcing for a concrete connecting collar, making the joint a monolithic structure. A form

was placed and dry concrete was rammed through an opening at the top. This completed the joint and made a watertight installation. Backfilling over the exposed ends of the culvert complete the job.

The cost of the completed job was $2431.95, or only one-third of the estimated cost of placing this culvert by the falsework and open-trench method. The money value of the avoidance of slow orders and train delays was not estimated but the operating officers were pleased with the absence of traffic interference. The installation proved that the jacking method of installing culverts is a practical time and money-saving construction method of wide application in railway work.

The work was planned and carried through under the writer's direct supervision, with P. Hofacker, supervisor of bridges, actively in charge.

Railroads Are Increasing Economy of Maintenance Work

AN ANALYSIS of statistics which have recently become available covering maintenance of way expenditures, and the number of persons employed in maintenance of way work during the calender year of 1925, affords distinct evidence of the progress that has been made in increasing the efficiency of operations in this branch of the service. This analysis shows clearly that more material is being applied per man employed in maintenance of way work and that marked progress has been made in increasing the permanence of employment of the maintenance of way forces.

The trend towards greater permanence of employment is brought out by the table below, which shows the maximum number of employees, the minimum number of employees and the spread between the maximum and minimum forces in 1922 to 1925, inclusive.

Maintenance of Way Employees, Class I Railroads, Including Switching and Terminal Companies

	Minimum force.	Maximum force.	Spread.
1922	288,755	420,669	131,914
1923	326,627	471,185	144,558
1924	335,449	428,917	93,468
1925	329,983	431,822	101,839

In studying this table, 1922 should be compared with 1924 and 1923 with 1925 because 1922 and 1924 were years of restricted earnings during which maintenance of way operations were somewhat curtailed, whereas 1923 and 1925 were years of considerably larger earnings during which maintenance of way work was carried on on an extensive scale. We find that the spread between the maximum and minimum force in 1922 was 131,914 men, while in 1924 it was 93,468, or a reduction in the spread of 38,446 men in 1924 as compared with 1922. However, a comparison of 1925 with 1923 brings out an even more remarkable contrast. In 1923 the spread between minimum and maximum forces was 144,558 men, while in 1925 it was 101,839 men, or a reduction of the spread of 42,719 in 1925 as compared with 1923.

Expenditures in the Two Years Nearly the Same

This comparison is all the more remarkable because the total expenditures for maintenance of way and structures in those two years were so nearly the same. This was brought out in the table of expenses by month for maintenance of way and structures in those two years, where it is seen that the total expenditures in 1925 were $824,892,860, as compared with $821,376,694 for 1923, or a difference of only $3,516,166, or 0.44 per cent. However, the expenditures in these two years differed considerably as to their distribution by months. The maximum expenditure for the largest month in 1925, August, was $4,261,206 *less* than the expenditure for the most active month of 1923, October, while the expenditure in February, 1925, was $6,562,985 *greater* than for February, 1923, February being the month of minimum expenditures in both years.

The greater uniformity of expenditures in 1925 as compared with 1923 is shown graphically in the chart of expenditures in which the shaded portions show the months during which expenditures were greater

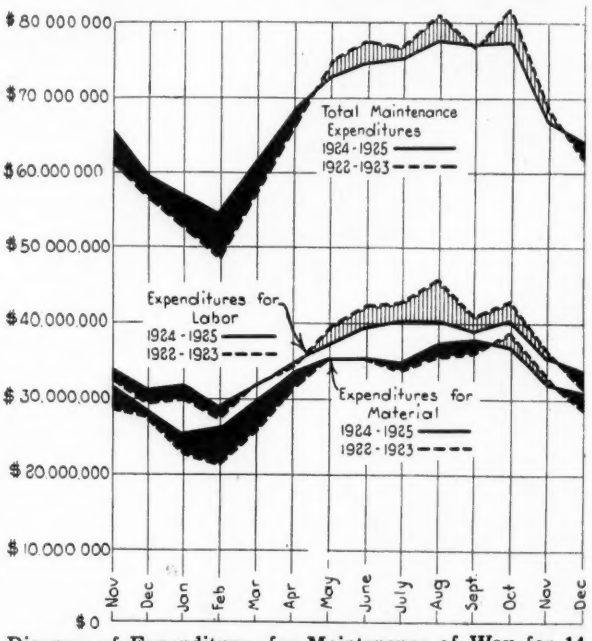


Diagram of Expenditures for Maintenance of Way for 14 Months in 1922-3 and 1924-5.

Heavy Black Parts of the Chart Indicate Periods When Expenditures in 1924-5 Were More Than in 1922-3. Hatched Portions of the Chart Indicate Periods When Expenditures in 1924-5 Were Less Than in 1922-3.

in 1925, while the hatched portions show the periods during which expenditures in 1925 were less than in 1923. In order to bring out the full significance between winter and summer expenditures in this chart the data for the months of November and December of the preceding years are also given and the chart shows clearly that during the later year expenditures were greater in the winter months and less during the summer months than in the earlier year.

This chart also shows separate graphs for labor and material expenditures and these also bring out

the effect of the more uniform distribution of expenditures throughout the year in 1925 as compared with 1923. However, a careful study of the labor and material charts discloses a rather remarkable difference. Considering first the curve for labor expenditures, it is seen that more labor was employed during the winter months of 1924-5 than in the corresponding period of 1922-3, while there was a marked reduction in expenditures for labor during the summer months of 1925. However, there was this notable difference—the reduction in summer expenditures was considerably larger than the increase in winter expenditures. This means that the total expenditures for labor in 1925 were appreciably lower than they were in 1923, the total in 1925 being $431,730,726, as compared with $444,303,538 in 1923, or a saving of $12,572,812.

Class I Roads, Including Switching and Terminal Companies

	Maintenance of way and structures expenses.		Total compensation paid maintenance of way employees.	
	1925.	1923.	1925.	1923.
January	$56,971,378	$52,834,350	$31,801,725	$29,955,984
February	54,923,944	48,360,959	28,839,804	27,254,384
March	61,090,232	57,140,357	31,787,150	31,871,108
April	68,091,818	65,224,501	34,810,231	34,151,504
May	72,473,731	74,473,432	37,099,264	39,401,511
June	74,749,192	77,241,548	39,420,020	42,220,124
July	74,959,550	76,461,700	40,204,591	42,809,993
August	77,486,514	80,895,847	40,297,728	45,571,541
September	76,754,627	76,488,904	38,909,518	40,772,647
October	77,158,242	81,747,720	40,284,290	42,864,033
November	66,402,072	68,577,472	35,014,387	36,157,078
December	63,832,421	61,785,586	33,262,018	31,273,631
Total	$824,892,860	$821,376,694	$431,730,726	$444,303,538

More Material Applied in 1925 With Less Labor

The natural conclusion to be obtained from this is that 1923 was a bigger year in maintenance of way work; in other words, that more work was done in 1923 than in 1925. But this conclusion is upset by the figures for the expenditures for material in the two years, which totaled $393,162,134 in 1925 and $377,073,156 in 1923, or a gain of $16,088,928 in 1925 over 1923, and since, as is well known, the general average of prices in 1925 was lower than in 1923, this means that more material was applied in the later year than in the earlier one.

Class I Roads, Including Switching and Terminal Companies

	Maintenance of way employees.	
	1925.	1923.
January	330,420	326,783
February	329,983	326,627
March	338,667	342,353
April	379,377	380,513
May	409,787	418,894
June	422,373	445,765
July	431,517	456,090
August	431,822	471,185
September	428,808	450,013
October	425,647	436,865
November	395,301	409,819
December	362,224	355,766
Total	390,494	401,723

This fact is brought out more clearly in the lines on the chart showing the cost of material applied in the two years, from which it is seen that the cost of maintenance of way material applied in 1925 exceeded that applied in 1923 in all except two months, October and November. The conclusion to be drawn from this is that with only a moderately larger force during the winter months and a considerably smaller force during the summer months of 1925 the railroads were able to apply more material during all but two months of 1925 than they were able to apply in 1923.

Another significant fact brought out by this diagram is that the gain in the amount of material applied in 1925 was much greater in the winter months than it was during the summer months, a point which can lead to but one conclusion, namely, that the employment of a moderately larger number of men during the winter months and a definite campaign to keep these men profitably employed in productive work has resulted in a marked increase in the efficiency of winter work in the maintenance of way department. Obviously a number of other factors have to do with the improvement in the showing, but it should be clear that efforts to increase the continuity of employment in maintenance of way work was the most important influence.

Southern Pacific Lines Report Results of Annual Inspection

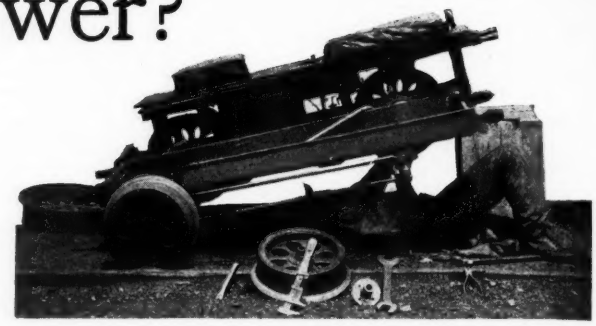
THE REPORT of the annual inspection of the Southern Pacific Lines in Texas and Louisiana for 1925 has just been published by that company in the form of a booklet which gives the ratings of condition of the track and right-of-way for each section, embracing about 4500 miles of road. In addition to the ratings by sections and districts general averages are given for each division. The El Paso division, for the fourth consecutive year, had the highest average condition, and George Caufield of that division achieved the distinction of having the best maintained section on the system, while the El Paso district of that division, in charge of P. P. Marion, received the highest rating of any roadmasters subdivision. As in the past, cash prizes of $100 were awarded the foreman having the best section on each district, while prizes of $75 and $50 were awarded the foremen of the second and third best sections, respectively.

The conditions of all roadway and station buildings, section quarters, shops and terminal facilities and other fixed units of the property were noted carefully and scored by the members of the inspection party. In this report, for the first time, is given a statement showing the comparative efficiency ratings of stationary boiler plants, both individually and by divisions. The company has made marked savings in the past two years as the result of a vigorous campaign to improve conditions at its boiler plants and this inspection showed that gratifying progress had been made in this respect during 1925. A list of "perfect" facilities is given and as an indication of the care taken in their maintenance it is of interest to note that the list includes 80 pump-houses, 243 stations, 31 shops and engine houses, 24 fuel oil plants, 35 signal towers, 206 section houses and 96 miscellaneous structures.

An honor roll is given which contains the names of 567 foremen in the maintenance and mechanical departments in whose gangs no reportable accidents occurred during the year. Of these foremen, 96 had no casualties for four consecutive years, 66 others had none for three consecutive years, while of the remainder 129 had none for two consecutive years.

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities



QUESTIONS TO BE ANSWERED IN THE JULY ISSUE

1. *What can be done to improve conditions under railroad crossings where opportunity for natural drainage is lacking?*

2. *What is the best method of leveling up the slabs in a concrete trestle where some of the piles have settled?*

3. *What is a reasonable output per man in replacing ties in gravel and crushed stone ballast, respectively?*

4. *What is the best method of fastening sheet metal fire protection to the deck of a bridge, from the standpoint of ease of removal when necessary to make repairs to the bridge?*

5. *Spiral curves are preferably of such length as to coincide with the run-off for the superelevation of the curve. If for any reason a material change is made in the superelevation of the curve, should the spirals be changed where the speeds do not exceed 55 or 60 miles per hour?*

6. *What are the relative economies of copper and iron wire screens for railroad buildings?*

7. *Should switch stands for main track turnouts be placed on the frog side of the track or should they always be placed on the engineman's side for trains facing the switch?*

8. *Are there any devices which will indicate underground water supplies?*

How Should the Spacing of Ties Be Done?

When spacing ties, should the distance be measured from center to center of the ties, or should the space be fixed between the sides of the ties?

The Distance Between the Ties Should Be Used

By Roadmaster

It will usually be found that spacing ties by measuring the distance between their sides is more economical and satisfactory in all respects than to measure the distance from center to center, since it can be done quickly and will always provide sufficient room in the crib to allow the shovel to be used without interference. In the case of sawed ties of fairly uniform size, either method will give substantially the same spacing, but with hewn ties variations in the width of face or in the rounding sides of the ties will cause variations in the spaces between ties if they are placed at fixed distances between centers.

Economy in Using Distance Between the Ties

By L. Coffel

Supervisor, Chicago & Eastern Illinois, Momence, Ill.

It is not economical to attempt to measure the distance from center to center of track ties when spacing. With 20 hewed ties to the 33-ft. rail the space between the sides of the ties will be approximately 10 in. and the standard No. 2 track shovel supplies a convenient tool for measuring this distance since it is always available when doing this class of work and its blade has a width of 10 in. when new, or a width of 9 1-2 in. when worn to the limit of use. This method, of course, must be used with good judgment to allow for variation in the width of ties. The space between adjacent ties should not be less than 10 in. or it will interfere with the use of the shovel when cribbing out. Spacing should begin at the joint tie, and this tie should be placed at right angles to the rail, which may be done easily by using the track gauge as a guide. With switch ties, on the other hand, it is more convenient to chalkmark the rail for the center of the ties, since they are usually sawed ties of uniform width of face. To attempt to measure for the centers of track ties would involve a loss in time and money that can better be used for other needed work.

Pneumatic Tools for Small Jobs

What is the smallest job of bridge renewal work on which it is economical to use portable air compressors and pneumatic tools?

Decision Requires Study of Each Job

By E. H. Brown

Supervisor Bridges and Buildings, Northern Pacific, Minneapolis, Minn.

Assuming that the question covers light repairs and renewals on steel bridges, my opinion is that it is neither practical nor feasible to promulgate rules or instructions to govern such cases. Every job of this kind requires some individual consideration as to equipment and tools. On large jobs there is little question in regard to using air and air operated tools, so that the question of economy in plant and equipment is one of location, quantity, type, etc., while on

the smaller jobs the question of using hand tools should be considered. In a general way it might be stated that where there are at least 200 rivets of not less than 3-4 in. diameter to be driven or any appreciable amount of drilling or reaming to be done consideration should be given to use of an air compressor and air-driven tools.

No Absolute Standard Can Be Set

By J. T. Andrews

Assistant Engineer, Baltimore & Ohio, Baltimore, Md.

This is a matter for which it is difficult to set an absolute standard. For large erection jobs there is, of course, no question as to the economy and, in fact, necessity of air operated tools, but for small repair jobs where there is a large amount of miscellaneous work, such as rivet cutting, drilling and riveting, local conditions will so largely govern that no definite figure can be set as to the minimum amount of work which would make the use of pneumatic tools economical.

As a general proposition, it is true that with pneumatic tools an equal number of men can probably accomplish at least twice as much work as by hand. If a small portable air compressor outfit is available and the work is so located as to make it unnecessary to lay any long air lines, it is probable that any job which will involve two or three days' work would justify the use of the air outfits. If the small portable machines such as are now on the market are not available and it is necessary to set up a more elaborate plant, its use would be justified only when about two weeks' work is involved.

The above is based on the premise that the economy is determined by the relative cost of the handling and setting up of the pneumatic plant as against the saving in cost of operation by air tools. This is a matter which can be determined locally in each case, but takes no account of the increased efficiency and better work secured by the machines.

Improving the Line-Holding Qualities of River Gravel

Where river gravel consisting largely of waterworn pebbles is used as ballast, what can be done to improve the line-holding qualities of the ballast?

Use a Liberal Percentage of Sand or Crush the Larger Pebbles

By W. S. Hanley

Chief Engineer, St. Louis Southwestern, Tyler, Tex.

Where river gravel is used consisting largely of waterworn pebbles the aggregate should contain about 40 per cent of sand and a liberal cross-section should be employed; sufficient rail anchors should be applied and slot spiking eliminated. Where the aggregate is deficient in sand, it is advisable to run the larger sizes through a crusher.

Use Sand or Cinders to Fill the Voids

By Engineer of Maintenance

River gravel used for ballast is usually run over a washing table to remove an excess of sand and then over a screen to remove the larger pieces. Where the pebbles are so waterworn as to be deficient in line-holding qualities, a sufficient amount of sand should be left in to fill the voids between the pebbles. If the gravel does not carry enough sand naturally for this purpose, coarse sand from other sources, if available, may be distributed with the gravel. If the gravel contains a sufficient proportion of large pieces it will often be found economical to run them through a crusher as they come from the screen, the angularity of the crushed particles aiding materially in holding line. Good results have been obtained by mixing cinders with the gravel where neither sand nor crushed materials are available.

Sanitation of Boarding Cars and Bunk Houses

What measures should be taken to insure sanitary conditions in boarding cars and bunk houses for track forces? Should this be left to the division officers or should it be co-ordinated for the entire road?

A General Policy Is Recommended

By F. G. Jonah

Chief Engineer, St. Louis-San Francisco, St. Louis, Mo.

A general policy should be adopted for the sanitation of boarding cars and bunk houses for an entire railway system, modified only by climatic conditions in various parts of the system. It is apparent that boarding cars, bunk cars and bunk houses should all be screened. In many sections of the country this is absolutely necessary as a protection against mosquitoes, and in other sections of the country where mosquitoes are not prevalent the flies are very apt to be, so that screening can be regarded as necessary. The construction of privies and coverings for them where bunk cars are spurred out temporarily should be uniform over the system, and the requisite amount of disinfectants used in all these places. Methods of lighting and heating these cars should be worked out uniformly. A standard of good food and good water should be insisted upon for these outfits. I believe that more satisfactory results will be obtained by establishing these standards in the office of the general manager than by letting each division work out what it may regard as necessary, and nothing more. The cars should always be well equipped, because they are moving from one division to another. They may possibly be on northern territories in the summer time and on southern territories in the winter, and if a system standard is maintained the cars will be in good shape for movement at any time.

A Suggested Sanitary Code

By H. W. Van Hovenberg

Sanitary Engineer, St. Louis Southwestern, Texarkana, Tex.

To insure sanitary conditions in boarding cars and bunk houses for track forces, I would suggest a sanitary code somewhat as follows:

(1) Inspection—Systematic inspection of camp cars or bunk houses should be made by a sanitary inspector or by a man who has had training under a sanitary engineer, the results of each inspection to be recorded on an inspection report card.

(2) Food Sanitation—Proper provision to be made for plenty of hot water for cleaning the utensils for preparing and serving food; inspection of food supplies for soundness and quality, and periodical examination of cooks and waiters for communicable diseases.

(3) Water Sanitation—Care must be taken to insure that the water supply be drawn only from approved sources, that each container be treated with

chlorinated lime on its arrival at camp and that the water supplied at camp be handled in a sanitary manner.

(4) Waste Disposal—Proper privy facilities to be provided so as not to endanger the health of the personnel or the surrounding community and incinerators to be supplied to burn garbage and refuse.

(5) Insect Control—Bedbug and body lice infestations to be eliminated and proper screening provided to protect the men from mosquitoes and flies.

(6) Housing and Ventilation—Tight roofs, proper heating facilities, and sufficient ventilation and cubic air capacity per man to be insured. Clean bedding should be provided, the men should be required to sleep head to foot and proper facilities for washing and bathing should be furnished.

(7) Responsibility for Sanitation—The inspector should report to a system engineering officer in the operating department so as to be entirely separated from the maintenance of way department.

(8) Control—The control of sanitary conditions in bunk cars and boarding camps should be unified for the entire road.

Methods of Cleaning Out Water Tanks

What is the best way to clean out water tanks from the standpoint of cost, interruption to service, disposal and other factors?

Locations and Service Conditions Will Govern

By A. W. Johnson

Superintendent Water Service, Atchison, Topeka & Santa Fe, Topeka, Kan.

The cheapest method of washing out tanks will depend on their location and service conditions. Our practice is to empty a treating tank every six months, or less frequently, varying with the hardness of the water and amount used. This work is usually done between trains, except at terminals where we have several tanks, permitting one of them to be washed out without interrupting the service. When a tank is washed it is first emptied and then scrubbed out by water service laborers, at which time it is generally inspected for pitting. In addition to the above, our practice is to open the sludge valve on a treating tank from one to four times a day. Storage tanks are cleaned or washed every one or two years, depending on the character of the water.

Many Essentials Must Be Considered

By A. Waterman

The most satisfactory method of cleaning water tanks will depend very largely upon the design of tank, its location, the quantity of material to be removed and the length of time that the tank is available for the purpose of cleaning. Ordinarily if the tank is used for locomotive supply the length of time it can be taken out of service is limited to the time between trains requiring water, which under the most favorable conditions will probably not be more than two or three hours. If the tank is located at an outlying point, where it will not be objectionable to deposit the mud on the ground, or where the lay of the ground is such that it may be readily washed away, the problem is comparatively simple, as it is merely a question of shoveling the mud through an opening in the bottom of the tank which should be provided for that purpose in all cases.

Following the removal of the mud by shovels the tank should be thoroughly washed out with a hose. Care should be taken to protect the frame and tank from being spattered by mud as it is removed, and such mud as may be on the frame or tank should be washed away with the hose.

If time will not permit of the tank being kept out of service long enough to remove all the mud the process may be repeated at such intervals until the tank is cleaned. If the time for cleaning is very limited it is a good policy to gauge the time between cleanings to the amount of material that can be removed in the prescribed time.

If the tank is located at a passenger station or other point where it would be objectionable to deposit the mud on the ground it may be spouted direct into cars through a pipe or trough and hauled away for proper disposal. Where sewers are available it is often possible to wash the mud from the tank into the sewers. This will depend a great deal upon the character of the mud and the quantity, as well as the size of the drain.

It might be well to suggest that in selecting the design of a new tank the character of the water should be considered. For example, if the tank is to be used as a settling basin or treating tank it should be provided with a conical bottom and sludge drum so that the accumulated mud or sludge may be removed at will without taking the tank out of service. A sludge collecting system may be installed in a flat bottom tank for the same purpose, but it is never as effective as a conical bottom tank and the waste of water from sludging the tank is always many times greater.

Renewing Bridge Ties

Should bridge ties be renewed out of face or is it preferable to renew individual ties as they show signs of decay?

A Combination of Methods Is Advocated

By J. W. Hooper

Bridge and Building Supervisor, Nashville, Chattanooga & St. Louis, Marietta, Ga.

Bridge ties should be renewed by patching when the renewals do not amount to more than 40 per cent of the ties; if the percentage is greater, then all the ties should be renewed. I find a good plan in renewing ties on bridges containing some ties that can be used again is to renew all the ties in the bridge and to save the usable ties for patching on other bridges. My experience of 39 years in bridge work convinces me that from 40 to 50 per cent of the ties of certain classes will last from one to three years longer than ties of other classes due to the quality of the timber; consequently the full life of the best ties can be secured by patching in to replace the ties that fail first.

Various Conditions Govern

By F. C. Baluss

Engineer of Bridges and Buildings, Duluth, Missabe & Northern, Duluth, Minn.

There can be no hard and fast rule for either method. The maintenance officer must decide this in the light of the conditions existing at the bridge. When the ties are of standard dimensions I favor renewing the individual tie as becomes necessary, due to decay. The service life of ties received in the same shipment will often vary five or six years after

they are placed in a bridge. This is due to the different densities of ring growth in the timber and the location in the logs from which the ties are cut. I think 25 per cent more use can reasonably be expected of ties where individual renewals are made.

When ties are not of standard dimensions, such as in bridges on curves where the superelevation of the outside rail is obtained by tapered ties, it is probably more economical to renew all the ties at one time. The maintenance officer will be governed by the location of the bridge, its length, the difficulty of getting to the work and other pertinent reasons before adopting either plan.

It Depends on the Type of Structure

By P. C. Perry
Division Engineer, Canadian National, Regina, Sask.

Bridge ties should be renewed individually up to the point where the entire bridge or deck is renewed in the case of a wooden trestle. With a steel or concrete structure I would recommend individual renewals up to approximately 40 per cent. In both cases second-hand ties should be used for the individual renewals, if available, so that there will be no ties in the bridge with only a few years' service when the time comes for renewing out of face. Where renewal out of face is done there usually is a percentage of ties in such shape that they will last three or four years if used again for individual renewals in other bridges. We also have a good many serviceable ties taken from bridges filled, and by using them for individual renewals save considerable timber. The same remarks apply to stringer renewals in timber bridges, although I would not recommend individual renewals exceeding 25 per cent.

Supervision of Ballast Trains

In the operation of a ballast pit loading large quantities of ballast for various points on a railway, is it economical to assign an assistant trainmaster, or some similar officer, to direct the movements of the hauling crews?

Not Considered Necessary

By J. F. McDonald
Office Engineer, New York Central, New York

While the practice of assigning an assistant trainmaster or other similar officer to direct the movements of ballast hauling crews might be economical on some roads, it is not considered necessary on the New York Central, where it is found that a competent pit foreman working in close co-operation with the conductor of the ballast train accomplishes the desired results.

A Trainmaster Should Be Assigned

By Bernard Blum
Engineer of Maintenance of Way, Northern Pacific, St. Paul, Minn.

The largest element of expense in the operation of ballast work is the item of work train service. The actual cost of haul is a large share of the expense, and unless proper co-ordination of the haul crew schedule is maintained, delays at the shovel are likely to occur. For this reason the element of cost of supervision is a minor consideration and will in general be negligible in the total cost. The assignment of a trainmaster who has direct charge over the trainmen has been found to be beneficial. Such an officer, however, should work in close co-operation with the roadmaster or engineer in charge of the ballast work and be under his general direction. With the payment of overtime wages, delays must be reduced to a minimum. An efficient operating officer in charge of the work train crews will almost invariably be found economical.

Protection of Roofing Membrane on Concrete Slab Roofs

In case of buildings with concrete or other slab roof construction with tarred paper or other membrane covering what measures may be taken to prevent cracks in the membrane due to expansion and contraction?

A Provision for Expansion Bends in the Membrane

By Supervisor of Buildings

A method that has been used successfully to prevent the breaking of the membrane covering of concrete slab roofs consists in first applying a strip of roofing paper over the joints at such intervals that the movement due to expansion and contraction will not be excessive. The paper is put down by mopping to within a short distance of the joint and making a small bend in the paper above the joint, thus providing protection in much the same manner as is afforded by expansion bends in steam pipe lines. This method has also been used in repairing breaks in roofing where such provision had not been made in the original construction, the strips being applied to the roofing membrane over the line of fracture.

Attach Only Part of the Slab Surface

By M. H. Doughty
Division Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

To prevent cracks in membrane of roof covering, due to expansion and contraction of the concrete or other roof slab, we have made it a practice to lay a strip, about 15 in. in width, of the membrane over the expansion joints, putting it down dry so that it will not adhere to the slabs, and placing the roof membrane over this in the usual manner. This allows a strip of roof about 15 in. in width which is not attached to the slab.

On a certain large building having concrete roof slabs we did not mop the roof slabs in their entirety, but merely mopped the slabs in narrow streaks, covering approximately one-tenth of the total area. This system in the case referred to took care of expansion satisfactorily. Later in putting a new roof on the same structure we mopped the entire slabs. This new roof has been in place over a year and we have had no difficulty.

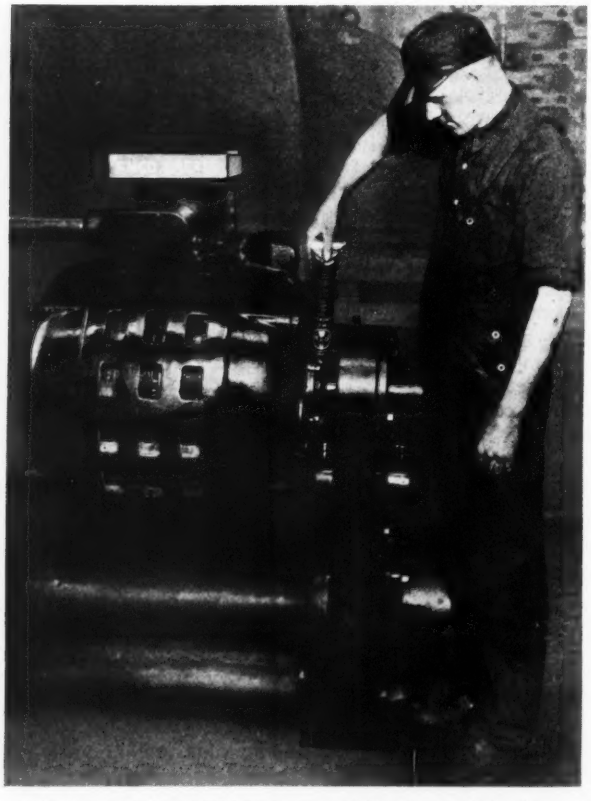
Competition for New Line Construction—The Atchison, Topeka & Santa Fe and it subsidiary, the Pecos & Northern Texas, have petitioned for Interstate Commerce Commission for a reopening for further testimony of the case in which examiners of the commission recently recommended the issuance of certificate to the Texas, Panhandle & Gulf for the construction of a new line in Texas in territory in which the Pecos & Northern Texas, and a subsidiary of the Burlington system had also applied for authority to build new lines. They also asked for leave to intervene in the case and that five cases, involving proposed construction of approximately 800 miles of new line in Texas, be consolidated into one proceeding.

Getting the Manufacturers' Help

Current Developments in New and Improved Labor Saving Appliances

Grease-Tube Method Simplifies Motor Lubrication

THE PROPER lubrication of electric motors used for pumping and other railroad service has been greatly simplified by the use of ball-bearings. In the use of these bearings Fairbanks-Morse & Company have demonstrated that the lubrication of this type of motor may be reduced to an operation requiring not over 20 minutes once a year by the use of a suitable grease. They have now introduced another improvement that further simplifies the work by furnishing the proper greases in collapsible tubes, each containing just enough lubricant for a single application.



Method of Using FMCO Grease-Tube for Lubrication of Fairbanks-Morse Ball-Bearing Motors

After flushing out the old grease with kerosene, the new FMCO grease is squeezed from the tube directly into the bearing. Four sizes of tubes are supplied for different sizes of bearing and printed directions are furnished so that the best results may be obtained.

Among the advantages claimed for this method are: The grease used is best adapted for ball-bearings, being free from grit or corrosive substances, and maintaining its consistency in all normal temperatures without being too stiff when starting in the cold, or melting and flowing out of the bearing when the motor is running at full load; no dirt or other deleterious matter is introduced into the bearing since the use of a stick for taking the grease from an open can is eliminated; in applying the grease it is necessary only to remove the plug from the housing of the bearing and no grease is wasted or smeared outside the bearing. It is further claimed that the method is economical since it is found that the slight cost of the tube is usually offset by the elimination of waste in the use of grease, while the efficiency of the bearing is improved and its service life prolonged.

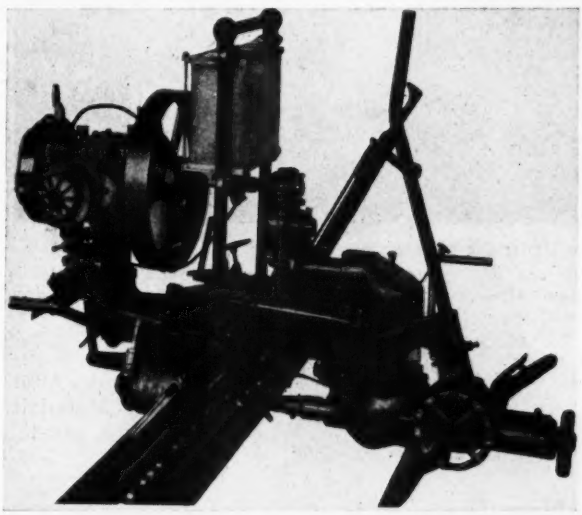
A New Power Track Drill

THE EVERETT power M-W track drill recently developed and placed on the market by the Railroad Accessories Corporation, New York, represents the application of the principles embodied in the Everett power bonding drill brought out by the same company four years ago to the drilling of bolt holes. It will drill holes up to 1½ in. in diameter through the webs of rails ranging from 65 lb. to 150 lb. to the yard, either in or out of track, and will drill within 2½ in. of the end of the rail with no other rail adjoining. It is said to drill a bolt hole in 30 sec. The machine weighs 300 lb. and can be operated by one man, who can also move it from joint to joint along the rail. It can be lifted and carried by three men by means of extension handles arranged conveniently for the purpose.

The clamping arrangement is made in two parts, the front clamp having one point of contact which is placed and locked in position against the web of the rail or the joint bar by the movement of a lever, while the rear clamp has two contacts which are brought against the head of the rail by means of two ball-headed screws and is operated by a latch lever. The clamp adjusts itself automatically for drilling through

the joint bars or through the bare web of the rail and insures that the bit is at right angles to the rail. The clamp is released easily and quickly and is so designed that adjustments are necessary only where there is a great difference in the size of the rails to be drilled.

The bit is raised or lowered to the horizontal position by means of an adjustable foot rest, and eccentrics attached to the shafts carrying the wheels provide means for raising or lowering the bit to compensate for variations in the height of the rails. An adjustable index indicator is provided on each side of the machine for spacing the holes properly in relation to each other and to the end of the rail. In operation the bit is advanced to the rail by turning a hand wheel at the lower end of the feed lever. When the feed lever is pulled back it engages the feed rack automatically. By lifting the spring latch on the feed lever it can be made to engage the feed rack at any desired point on the arc so that the maximum leverage may be obtained when necessary. The lever feed is sensitive, enabling the operator to regulate the pressure and to avoid forcing the bit, especially when the hole is nearly finished. When the hole is completed, the feed rack is disengaged by returning the feed lever to its original



The Everett Power Track Drill in Position for Operation.

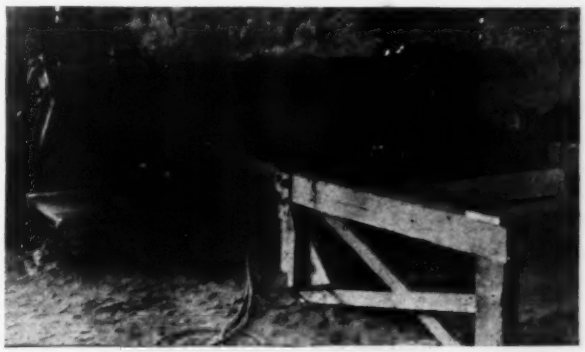
position and the bit is backed out by means of the hand wheel. The length of feed is 6 in. The spindle speed is from 85 to 90 r. p. m. The use of high speed steel flat drills is recommended and unless otherwise specified the machine is furnished with a chuck for that type of drill. It can, however, be equipped with chucks for twist drills, taper shank drills or round shank drills as desired. The machine is equipped with an oil tank and force pump for supplying oil to the drill point.

The machine may be equipped with either electric motor or an Everett gas engine drive, the latter being furnished unless otherwise specified. The Everett gas engine is a two-cylinder, two-cycle, air-cooled unit, developing 4 to 5 hp. at 1,500 r. p. m. It is equipped with a high-tension type flywheel magneto ignition and a Zenith carburetor, type V4B of the jet type. A convenient rope starter is provided. The drive is direct, through gears, from the engine to the drill, no clutch being used. The frame castings of the machine are of malleable iron. All parts are interchangeable and ball bearings are used wherever necessary. Grease and oil cups are provided and the gears run in grease.

Centrifugal Cast Iron Pipe Made in Sand Lined Molds

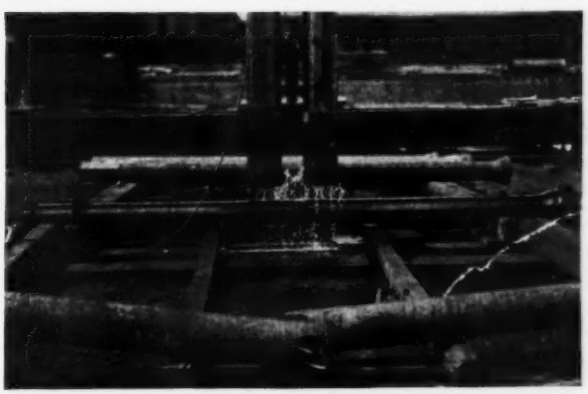
A PROCESS for making centrifugal cast iron pipe in refractory molds has been developed by the American Cast Iron Pipe Co., Birmingham, Ala., which has adopted the trade name "Mono-Cast" pipe for this product. A new plant, capable of being operated 24 hours a day, with a daily capacity of 50,000 lin. ft., is nearing completion and is expected to be in full operation by the middle of May.

The pipe is cast in a metal flask lined with molding sand. Atfer the mold is placed horizontally in the



The Centrifugal Casting Machine Ready to Receive the Flask

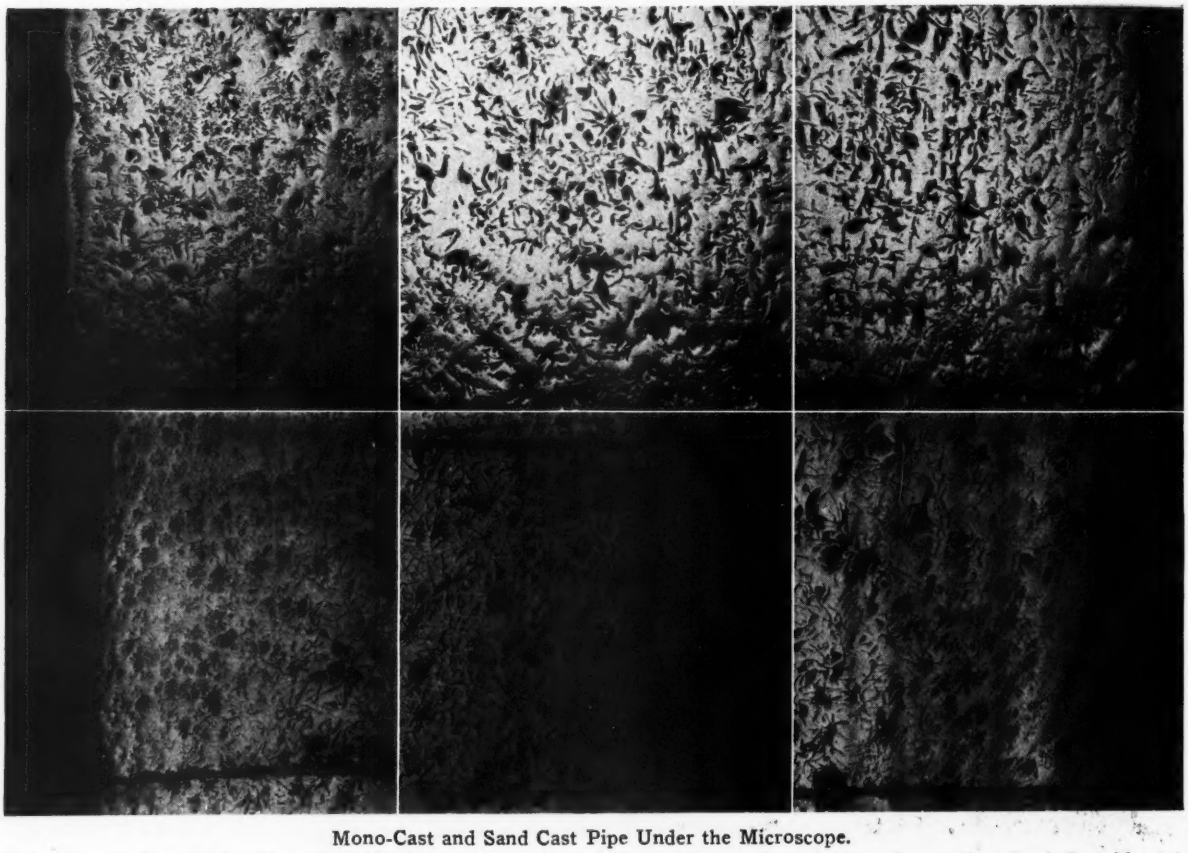
centrifugal casting machine a charge of molten metal is poured into it which distributes itself over the bottom of the mold for its entire length. When the proper amount of metal has been introduced the mold is revolved at a high rate of speed and the centrifugal force developed causes the metal to be distributed on the face of mold in a layer of uniform thickness. When the metal has cooled sufficiently to hold its shape the machine is shut down and the flask is romoved. Among the claims made for this method of manufacture are: that no internal casting strains are developed; that the casting is not chilled; that it insures a



Subjecting Mono-Cast Pipe to a Shatter or Drop Test

dense, fine-grained structure of uniform texture and surface, free from inclusions of dross or of gas pockets or blowholes, and that the pipe is true to pattern throughout.

For the present the pipe will be supplied in five sizes from 4 in. to 12 in. in diameter, varying by increments of 2 in., and in lengths to lay 16 ft. with bell and spigot ends with bead cast on the end of the spigot. Water pipe is made in seven standard weights



Mono-Cast and Sand Cast Pipe Under the Microscope.

Upper Row Left to Right—Mono-Cast Metal near outer edge, middle and inner edge of pipe. Lower Row-Sand Cast Metal in same relative positions. Note that Mono-Cast Metal is chilled only on outside edge and that the chill on the outside is not as deep as in sand cast pipe. The graphite foundation in the middle section of the Mono-Cast Pipe is not as coarse and does not form as continuous a network as in the sand cast pipe.

designated as Classes 100, 150, 250, 350, 450, 525, and 600. Classes 350, 450, 525 and 600 correspond in dimensions, metal thickness and weight to Classes A, B, C, and D, respectively, of the American Water Works Association specifications, while Classes 100, 150 and 250 are of lighter weight but have the same bell and spigot dimensions as Class A of the American Water Works Association specifications. Gas pipe is supplied in three standard weights: Classes 150, 350 and 450, class 350 being the same in dimensions, thickness of metal, and weight as prescribed in the American Gas Association specifications. The three classes have the same bell and spigot dimensions.

It is claimed for the pipe made by this process that since the metal is cast in a refractory mold without a core the structure is very dense with a fine close grain on the outside of the pipe, changing gradually to a normal medium grain on the inside, the microscope showing a fine skin on the outside and with fine graphite whorls which increase gradually in size until the inner surface is reached. In addition to its other advantages this renders the metal more highly resistant to corrosion. It is also claimed that this pipe has 40 per cent greater resistance to hydrostatic pressure, 20 per cent greater resistance to cross bending and 25 per cent greater resistance to shock than pipe cast by the ordinary process in sand molds, and that on this account the factors of safety formerly used for computing wall thicknesses for given hydrostatic pressures can be reduced materially for Mono-Cast pipe.

The manufacturer has prepared specifications for Mono-Cast pipe, which are in general conformity with the specifications of the American Water Works Association, the American Society for Testing Materials, the New England Water Works Association and the American Gas Association.

New Motor Car with Safety Features

THE Northwestern Motor Company, Eau Claire, Wis., has brought out a new section motor car, the Casey Jones 521, of the belt-driven type, equipped with the Casey Jones Standard Six free-running engine with ball bearings. Improvements in the design

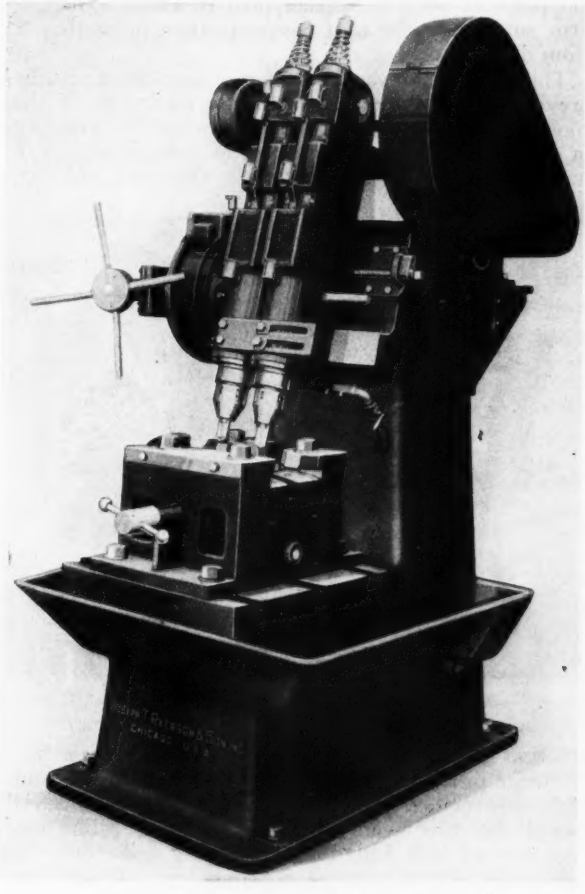
The Casey Jones No. 521 Section Motor Car With "Safety Step-Ons."

of the engine permit a reduction of 50 lb. in the weight of the car, while the reinforced construction of the frame provides ample strength with no increase in weight. The axles are provided with Hyatt roller bearings and with adjustable clamp type collars to prevent lateral thrust. A feature making for safety is found in the "safety step-ons" at the rear of the car which provide a convenient means for men to mount the car when it is started by pushing. Standard equipment includes deep tool trays, safety rails, convenient lift bars, and draw bars, while special equipment may be furnished as desired.

Special attention has been devoted to simplicity in the engine design and it is claimed that any man can dismantle and re-assemble the engine in two hours when necessary. The engine is equipped with a spring compensating belt-tightening lever, an adjustable sliding base, an adjustable safety hopper cooler and a Ford type carburetor with dash control.

An Inclined Rail Drill for Use in Rail Reclamation

AN INCLINED rail drill for drilling bolt holes in rail reclaimed by sawing has been developed by Joseph T. Ryerson & Son, Inc., Chicago, for use with its rail sawing outfits equipped with high speed friction saws. The new drill eliminates the necessity of turning the rail for the drilling operation and permits the rails to be slid into place at the drill in the same position in which they are sawed, thus increasing the output and reducing the expense of this operation.



The New Ryerson Inclined Rail Drill

The drill is a strongly built machine with either two or three spindles inclined at an angle to drill the holes at right angles to the longitudinal axis of the rail. The mechanism is driven by a motor carried on a bracket at the rear of the frame which transmits power to the drive shaft by a silent chain. Only six gears are used between the drive shaft and the spindle, the final gears being a wide-faced herringbone design with a fine pitch, made of heat treated and hardened alloy steel. A tank and pump for the circulation of the cooling liquid are provided inside the frame, the cooling liquid being strained after it leaves the drills before re-entering the tank.

The spindles are controlled by a single capstan wheel. Turning the wheel in a clockwise direction brings the drills rapidly to the rail where a slight further movement engages the feed. An adjustable feed knock-out is provided for disengaging the feed at the completion of the drilling, thus providing almost automatic operation with hand control. The spindles are made from 0.50 to 0.60 carbon steel forgings, carefully machined and provided with special alloy bronze bearings carried in a long, heavy sleeve. The thrust is taken by a large ball thrust bearing. The nose of the spindle is 3 in. in diameter, with five Acme threads to the inch to receive the clamping collet of the chuck, which is part of the spindle, and which holds the bit closely and eliminates overhang.

Two spindle speeds, 110 and 150 r. p. m., and three feeds, 0.0082 in., 0.0107 in. and 0.0139 in., are provided. The spindle speeds are changed by removing the cover of the speed box and interchanging the gears on the horizontal drive shaft. The change of feed is made in the same manner, an extra set of gears being furnished for the third feed. All bearings are provided with removable bushings of high-grade alloy bronze which combines the strength and durability of bronze with the bearing qualities of babbitt. All working parts are covered to provide protection for the machine as well as safety for the operator.

A Self-Propelled Rail Crane

THE PARSONS Company, Newton, Iowa, has placed on the market a gasoline operated self-propelling crane which has demonstrated marked economy in laying rail as well as in loading and unloading rail and other material. The crane, which is mounted on a low hung heavy structural steel frame, is equipped with a 26-ft. boom, having an extension that permits lengthening the boom to 35 ft. The capacity of the crane is 3,000 lb. at a 22-ft. radius or 2,000 lb. at a 35-ft. radius, thus allowing its use in loading or unloading rail in gondola cars, or in picking up two lengths of rail at the same time when coupled together. By the use of counterweights or rail clamps controlled by the operator on the deck, the crane can handle its capacity load at an angle of 90 deg. from the track.

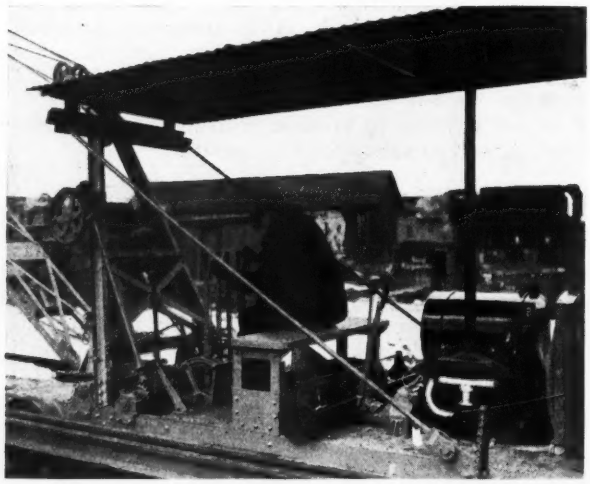
The car body frame is equipped with small flanged transverse take-off wheels for removing the machine from the track quickly. By hooking the fall line of the machine to the track, the operator can lift that part of the machine to which the transverse wheels are attached far enough above the running rails to permit rails to be placed under the take-off wheels. When the machine is in operation the take-off rails are carried alongside the frame on I-beams at the front and back of the machine, which can be pulled out sufficiently to make room for enough rails to furnish the requisite counterweight. Even with the

View of the Parsons Rail Crane in the Operation of Handling Rail

counterweight in place the crane can be run forward or backward along the track any desired distance.

Power is supplied by a Waukesha truck-type four-cylinder engine of 40 hp. at 1500 r. p. m. with all control levers placed in one bank within easy reach of the operator. The power swing and boom-hoist are operated by worm gear so that they are automatically locked in any position. The hoist drum is bronze bushed, 8 in. in diameter and is equipped with a twin disc clutch and an asbestos-lined band brake. of adequate size.

The power for traction drive is applied to the front axle through a diamond roller chain from a counter shaft on which are mounted two steel bevel



Arrangement of the Machinery of the Parsons Rail Crane

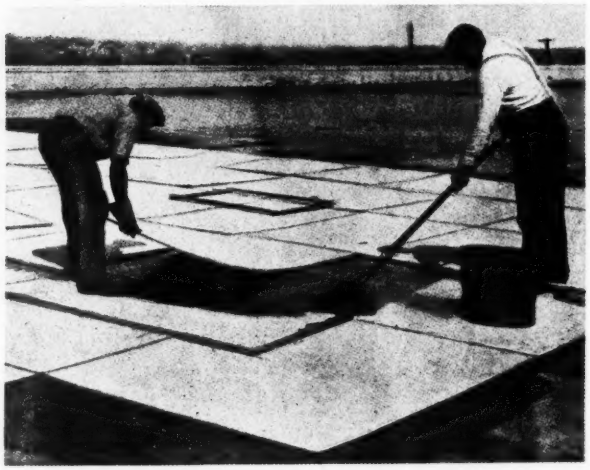
gears with cut teeth, driven from a bevel gear mounted on the main shaft. Each of the two driven gears is equipped with a twin disc clutch for easy and quick reversing without shifting gears. This arrangement also permits operating in either direction on any speed in transmission. The range of speed is from 2 to 22 miles per hour, thus saving time when running to or from work or when clearing the line for traffic. The engine has ample power to haul a complete rail-laying gang on trailers.

A crane of this type has been in operation on the Great Northern in North Dakota for about nine weeks where the normal performance with a gang of 54 men is a mile of track per eight-hour day. It is said that this record could be greatly increased with a moderate increase in the number of men. Besides speeding up the work, the use of the machine is estimated to save the wages of about 12 men.

Insulation for Concrete Roofs

THE Atchison, Topeka & Santa Fe, has insulated the concrete roof of a new roundhouse at Hutchinson, Kas., with Celotex industrial board, manufactured by the Celotex Company, Chicago, using two layers of the board under five-ply tar and gravel roofing. This material is made from firmly interlaced and felted cane fibre and is furnished in sheets 3 ft. by 6 ft., with a thickness of approximately ½ in. It is said to have high insulating value, to provide a good surface for moppings of pitch or asphalt, and to afford a rugged, firm support to the roof covering, thus protecting it from damage.

The principal advantages of roof insulation are the prevention of condensation on the underside of the roof structure, saving of fuel for heating the building in cold weather, protection from the heat of the sun in hot weather, and a reduction in the expansion and con-



Applying Celotex Industrial Board.

traction of the roof structure, an item of special importance in the case of roofs with concrete or gypsum slab construction. It is claimed for Celotex industrial board that two layers applied to a 4-in. concrete roof and covered with 5-ply built-up roofing will reduce the expansion of the concrete approximately 60 per cent, thus protecting the roof covering from injury.

With the Associations

Metropolitan Track Supervisors' Club

This club held its last meeting on April 10, for the purpose of discussing the committee report on rail anchors which was submitted at the meeting on January 9. An abstract of this report and the discussion appears on another page of this issue.

Maintenance of Way Club of Chicago

The meeting of this club, which was held on April 21, was devoted to a discussion of the methods pursued in fighting the blizzard of March 30. A report of this meeting will be found on another page of this issue. The next meeting will be held on May 19, with C. E. Johnston, vice-president and general manager of the Kansas City Southern as the speaker.

American Railway Engineering Association

The Board of Directors of the American Railway Engineering Association has again started off the work of the various committees effectively, through the promptness with which it has made the assignments of subjects and determined the personnel of the regular standing committees. This information was placed in the hands of the committee members in a statement dated March 26, or within less than three weeks of the closing of the last convention.

As a result of this prompt assignment of committee work 10 of the committees have already held their first meetings and plans have been made for the holding of other committee meetings within a few days.

The roster of committees indicates a change in the name of the Committee on Signs, Fences and Crossings to that on "Grade Crossing Design, Protection and Elimination" and also the transfer of the subjects of this committee pertaining directly to fencing, to the Committee on Roadway. It also shows many changes in the committee personnel and the fact that there are nine new committee chairman: J. C. Wrenshall, Committee on Roadway; J. G. Bloom, Committee on Ballast; Earl Stimson, Committee on Rail; J. B. Maddock, Committee on Wooden Bridges and Trestles; J. H. Hande, Committee on Records and Accounts; B. R. Leffler, Committee on Iron and Steel Structures; R. F. Layng, Committee on Economics of Railway Location; J. C. Irwin, Committee on Uniform General Contract Forms; and J. M. Farrin, Committee on Economics of Railway Operation.

An outline of the subjects assigned to the various committees, together with the names of their chairmen, follow, with the new subjects assigned for the first time shown in italics.

Roadway—Study of corrugated metal culverts; unusual methods of handling problems in connection with slips, slides and water pockets; deformation of roadbed in the light of information developed by the Committee on Stresses in Railroad Track; methods of drainage of roadway in yards and main lines where there are three or more tracks; improved methods of preventing corrosion of fence wire; specifications for steel fence posts; *methods and advisability of constructing a permanent roadbed.* J. C. Wrenshall, engineer maintenance of way, Reading Company, Reading, Pa.

Ballast—Relative value of stone from various quarries and report on method of determining; relative value, from the standpoint of effect on operating expenses, of various kinds of ballast; shrinkage of ballast; the cause of pumping joints; collaborating with the Committee on Track. J. G. Bloom, engineer maintenance of way, Chicago, Rock Island & Pacific, Chicago.

Ties—Service records; extent to which A.R.E.A. specifications are being adhered to; report on substitute ties; *the use of anti-splitting devices and specifications for same; proper size hole for pre-boring;* renewal of switch ties out of face by sets as against renewal of individual ties; *confer with proper representatives of federal and state authorities with a view of securing uniformity in annual reports, made by the railroads relating to cross-ties, as will permit proper comparison of results obtained by various railroads.* W. J. Burton, assistant valuation engineer, Missouri Pacific, St. Louis, Mo.

Rail—Details of mill practice and manufacture as they affect rail quality; rail failures; transverse fissures; cause and prevention of rail battering; gas welding of propulsion and signal bonds; *economic value of different rail sections.* Earl Stimson, chief engineer maintenance, Baltimore & Ohio, Baltimore, Md.

Track—Study and report on the matter now appearing in the Manual relating to curve elevation, canvassing the various railroads with a view of ascertaining their practices and views, and recommend such changes as are found to be desirable; detail plans of switches, frogs, crossings and slip switches, including self-guarded frogs, collaborating with the Committee on Signals and Interlocking; track construction in paved streets; *specifications and designs for foundations under railroad crossings; also tie spacing or timbering under crossings.* J. V. Neubert, engineer maintenance of way, New York Central, New York City.

Buildings—Specifications for concrete for railway buildings, collaborating with the Committee on Masonry; *steel sash versus wood sash for railway buildings; artificial lighting for railway buildings; plastic and composition floors for railway buildings; permissible grades for ramps for railway buildings; methods for improving office arrangements (lighting, ventilation, conveniences, etc.); various forms of unit construction for railway buildings; various substitute materials for wooden construction of railway buildings, with special reference to economic features;* rules and regulations governing the conduct of employees of the Building department, collaborating with the Committee on Rules and Organization. W. T. Dorrance, designing engineer, New York, New Haven & Hartford, New Haven, Conn.

Wooden Bridges and Trestles—Continue work of co-operation and collaboration with other organizations in simplification of grading rules and classification of timber and lumber for railway uses; value of treated timber in wooden bridges and trestles; the best methods of maintaining at a minimum, consistent with economy, the quantity and multiplicity of sizes of lumber and timber carried in railway stock. J. B. Maddock, engineer bridges and buildings, Central of Georgia, Savannah, Ga.

Masonry—Developments in the art of making concrete; *keep in touch with the action of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete and report such to the association; the principles of design of concrete, plain and reinforced, for use in railway structures; specifications for foundation work, including excavations, cofferdams, piling, etc.* C. C. Westfall, engineer bridges, Illinois Central, Chicago.

Grade Crossing Design, Protection and Elimination—Methods of apportioning the cost of street and highway improvements adjacent and parallel to railway rights-of-way; *the value and safety of various forms of manual or power-operated grade crossing protection as against crossing watchman protection; collaborate with the Committee on Signals and Interlocking, on various types of mechanical and power-operated grade crossing protection devices and their relative merits; laws and regulations affecting the apportionment of federal aid; the proper form and character of division of costs of separation of grades as between the railway and the state, county, municipal or other corporation; the character and extent of unnecessary or duplicated highway crossings over railways, with methods for their combination and consequent elimination; economic aspect of grade crossing protection in lieu of grade separation.* T. E. Rust, chief engineer, Waterloo, Cedar Falls & Northern, Waterloo, Iowa.

Signals and Interlocking—Automatic train control; automatic signals for highway crossing protection, collaborating with the Committee on Grade Crossing Design, Protection and Elimination; *signaling (designs; symbols; definitions; rules and instructions; construction and maintenance specifications).* F. B. Wiegand, signal engineer, New York Central (West of Buffalo) Cleveland, Ohio.

Records and Accounts—Methods and forms for gathering and recording data for keeping up to date the physical and valuation records of the property of railways; methods for recording and accounting for the determination of proper allowances for maintenance of way expenses due to increased use and increased investment, collaborating with the Committee on Economics of Railway Operation; daily and monthly time and material reports; revision of I.C.C. Classification of Accounts; methods for reducing the number and the simplification of forms used in Engineering and Maintenance of Way Departments; *the use made of aerial surveys and results obtained.* J. H. Hande, accounting engineer, Baltimore & Ohio, Baltimore, Md.

Rules and Organization—Rules for inspection of bridges, trestles and culverts; *collaborate with the Committee on Buildings, on rules and regulations governing the conduct of employees of the Building department.* "Manual of Rules for the Guidance of Employees of the Maintenance of Way Department." W. C. Barrett, trainmaster, Lehigh Valley, Sayre, Pa.

Water Service—Progress of regulations of Federal and State authorities pertaining to drinking water supplies; pitting and corrosion of boiler tubes and sheets; cost of impurities in locomotive water supply and the value of water treatment; methods of heating water stations and protecting tanks, water columns and other water facilities against frost, collaborating with the Committee on Buildings; *necessity for providing duplicate or stand-by pumping units, collaborating with the Committee on Economics of Railway Operation; the use of gravity and pressure filters; methods of disposal of sludge at water softening plants; the design and maintenance of track pans for locomotive supply, collaborating with the Committee on Track; methods used in securing successful wells in fine sand formation; the spacing of water stations and capacity of engine tenders, collaborating with the Committee on Economics of Railway Operation.* C. R. Knowles, superintendent water service, Illinois Central, Chicago.

Yards and Terminals—Joint operation of passenger terminals and the proper size of such facilities as determined by the business handled; study of scales with respect to the following: (a) automatic indicating devices for weighing; (b) tolerances for railway weighing devices; (c) tolerances for testing, adjusting and maintaining railway track scales; (d) capacity for motor truck scales; (e) analysis of Bill H.R. 4465 to regulate and control the manufacture, sale and use of weights and measures and weighing and measuring devices for use or used in trade or commerce, and for other purposes; (f) revise combined commodity and scale tolerance; freight yard design, suggesting economies in operation; layout for icing cars, etc.; me-

chanical means for controlling or retarding the movement of cars in hump yards. J. R. W. Ambrose, chief engineer, Toronto Terminals Railway, Toronto, Ont.

Iron and Steel Structures—Specifications for steel highway bridges; electric welding of connections in steel structures; maintenance of bridges, including equipment for that purpose; investigations and tests of I-beams connected in groups by diaphragms and bracing; the behavior of bridge pins; column tests; specifications for steel tanks and their supports, for the storage of water and oil, collaborating with the Committee on Water Service; *specifications for the waterproofing and drainage of solid-floor railway bridges; copper-bearing steel for structural purposes; instructions for maintenance inspection of superstructures of steel bridges, collaborating with the Committee on Rules and Organization; the use of alloy steels for bridges, with special reference to economic features; the bearing pressures on large rollers.* B. R. Leffler, engineer of bridges, New York Central (West of Buffalo), Cleveland, Ohio.

Economics of Railway Location—Economics of railway location as affected by the introduction of electric locomotives, conferring with the Committee on Electricity; the relative merits of a 0.4 per cent ruling grade as compared with a 0.3 per cent grade; the relative merits of increasing tonnage by the reduction of ruling grades or by the introduction of more powerful locomotives, including the consideration of momentum grades and the availability of the locomotive booster; locomotive tractive forces, giving special attention to oil burning locomotives, collaborating with the appropriate Committee of Division V—Mechanical, American Railway Association. F. R. Layng, engineer of track, Bessemer & Lake Erie, Greenville, Pa.

Wood Preservation—Service records; preservative treatment of trunking and capping, collaborating with the Committee on Signals and Interlocking; marine piling investigation; the treatment with creosote and petroleum; the treatment with zinc chloride and petroleum; *the preparation of structural material before treatment with preservatives.* S. D. Cooper, assistant manager treating plants, Atchison, Topeka & Santa Fe, Topeka, Kansas.

Electricity—Electrical interferences caused by propulsion circuits, continue representation on the American Committee on Inductive Co-ordination and collaborate with appropriate committees of the Telephone and Telegraph Section and with the Signal Section; the utilization of water power for electric operation, with particular reference to tidal water power and power from the St. Lawrence river; collaborate with the American Committee on Electrolysis; collaborate with the United States Bureau of Standards in the revision of the National Electrical Safety Code and other codes of similar character; continue the study of electric light, power supply and trolley lines crossing railways; continue the state representatives and their alternates; economics of railway location as affected by electric operation, collaborating with the Committee on Economics of Railway Location; specifications for rubber tape, collaborating with appropriate committees; revise the tables showing Third Rail Clearances and tables showing Overhead Working Conductor Clearances and extend them to include data showing location of the third rail above the plane of the running rails and beyond the gage line; report on rules for the protection of oil sidings from danger due to stray currents, collaborating with appropriate committees; specifications for track and third rail bonds for electric railway circuits, including gas, electric and thermit welding. Edwin B. Katte, chief engineer, electric traction, New York Central, New York City.

Uniform General Contract Forms—Form of agreement for furnishing water from railway water systems to employees and others; form of agreement for the joint use of freight station facilities; form of contract for purchase of water, collaborating with the Committee on Water Service; form of agreement for use of railway property for public highways, collaborating with the Committee on Grade Crossing Design, Protection and Elimination; *form of construction contract for particular item or items of work, collaborating with appropriate committees; form of contract for cost-plus percentage work.* J. C. Irwin, valuation engineer, Boston & Albany, Boston, Mass.

Economics of Railway Operation—Methods of increasing the capacity of a railway, co-operating with appropriate committees of the Signal Section and the American Association of Railway Superintendents; methods of analyzing costs for the solution of special problems, including a study of the costs of starting and stopping trains; methods of operation by which the intensive use of facilities may be secured; development of suitable units for comparing costs of operation and equipment maintenance; *determine what volume of service conditions in any given yard will justify a change from flat switching operation to the hump method, collaborating with the Committee on Yards and Terminals; branch line operation as affected by the introduction of motor trucks and bus lines.* J. M. Farrien, assistant engineer, Illinois Central, Chicago.

Economics of Railway Labor—The extent to which it is practicable to stabilize employment in the maintenance of way department in the interest of efficiency and the necessary measures to accomplish it; economy in the use of labor-saving devices; methods of maintaining motor cars with respect to rules for care and operation of motor cars and the standardization of motor car parts; *equating track values for labor distribution.* C. C. Cook, maintenance engineer, Baltimore & Ohio, Baltimore, Md.

Committee on Shops and Locomotive Terminals—General layouts and designs of coaling stations, collaborating with the Committee on Buildings; general layouts and designs of typical locomotive repair shops, collaborating with Committee on Buildings; storehouses and shops and locomotive terminals, collaborating with the Committee on Buildings; *typical layouts for storage and distribution of fuel oil, including fuel oil stations between terminals.* F. E. Morrow, assistant chief engineer, Chicago & Western Indiana, Chicago.

Co-Operative Relations with Universities—A greater interest upon the part of railroad officers in assisting the universities to develop the best possible methods for the technical courses; a better means of bringing to the universities the results of our deliberations, where such can be made of value to them; a better means of bringing to the attention of the railroads the benefits of a technical education, thereby acquainting them with the qualifications of graduates of these courses for initial service in subordinate positions, and at the same time providing material from which men may be drawn for higher positions as they demonstrate their fitness; a means of stimulating a greater interest in the science of transportation among engineering students who may be inclined toward this branch of industry; a means whereby the facilities of the universities may be made more directly available for the research work of the association by co-operative effort between their laboratories and the committees of the association; a means whereby the universities may be better enabled to educate the students and the public regarding the value of transportation to the nation as a whole; a means of stimulating a greater interest among university officials in the study of transportation and economics and impressing them with the importance of experienced men for such teaching. Robert H. Ford, assistant chief engineer, Chicago, Rock Island & Pacific, Chicago.

Special Committee on Stresses in Railroad Track—Stresses in railroad track. A. N. Talbot, professor of municipal and sanitary engineering, and in charge of theoretical and applied mechanics, University of Illinois, Urbana, Ill.

The Material Market

EXCEPT for some minor adjustments the level of prices for ordinary items of iron and steel has been maintained without change throughout the month. Curtailment in demand has been met by decreased production, which is now about 75 per cent of capacity. But in spite of this, the prevailing business has continued to become more and more a matter of orders for immediate delivery, with no marked indication of large increases in demand within the immediate future. Current quotations are therefore prices on prompt deliveries with little prospect of any advances in the near future. Possible exceptions to this trend are to be noted in the market for cast iron pipe, which has experienced a considerable increase in business during the spring months, while pending projects for large structural steel frame buildings give promise of a considerable demand for plates and shapes. Prices for wire nails and wire fencing are rather weak as a consequence of the lateness of spring, which has curtailed building work.

PRICES PER 100 LB.

	Pittsburgh	Chicago	Pittsburgh	Chicago
	March		April	
Track spikes	$2.90 to $3.10	$2.90 to $3.00	$2.85 to $3.20	$2.90 to $3.00
Track bolts	4.25	3.90 to 4.00	4.00 to 4.50	3.90 to 4.00
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.25 to 2.35	2.25	2.25 to 2.35	2.25 to 2.35
Boat spikes	3.25	3.25	3.25	3.25
Plain wire	2.50	2.55	2.50	2.55
Wire nails, keg	2.65	2.70	2.65	2.70
Barb. wire, galv	3.35	3.40	3.35	3.40
C.I. pipe, 6 in. to 12 in., ton		49.20 to 50.20		49.20 to 50.20
Plates	1.85 to 1.90	2.10	1.90	2.10
Shapes	1.90 to 2.00	2.10	1.90 to 2.00	2.10
Bars, soft steel	2.00 to 2.10	2.10	2.00	2.10
Rivets, struct.	2.50 to 2.60	2.75	2.50 to 2.60	2.75
Conc. bars, billet	2.00 to 2.10		2.00	
Conc. bars, rail	1.80 to 1.90	2.00	1.80 to 1.90	2.00
Rail, per gross ton f.o.b. mills		43.00		43.00

The scrap market is quiet and prices have experienced minor declines during the month, as indicated in the table below:

	March	April
Relaying rails	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	16.50 to 17.00	16.25 to 16.75
Rails less than 3 ft. long	17.50 to 18.00	17.00 to 17.50
Frogs and switches cut apart	15.25 to 15.75	14.75 to 15.25
Steel angle bars	16.50 to 17.00	15.50 to 16.00

The lumber market is suffering from the unprecedented delay in the arrival of spring. The backward season and the tendency of retail dealers to reduce their stocks to a minimum has resulted in an unseasonal falling off in the demand for lumber. This fact is to be noted in the weakening of prices for Southern pine, although it is not apparent in the quotations on Douglas fir, which do not reflect actual market conditions to the same degree.

SOUTHERN PINE MILL PRICES

	March	April
Flooring, 1x4, B and B flat	$48.71	$48.06
Boards, 1x8, No. 1	37.80	35.47
Dimension, 2x4, 16, No. 1 common	28.46	28.01
Dimension, 2x10, No. 1, common	30.96	29.43
Timbers, 4x4 to 8x8, No. 1	29.50	31.32
Timbers, 3x12 to 12x12, rough	42.46	

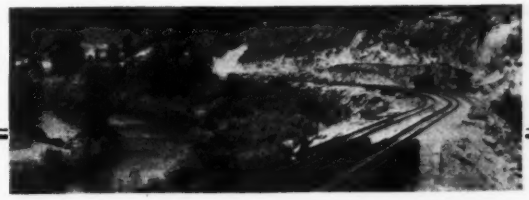
DOUGLAS FIR MILL PRICES

	March	April
Flooring, 1x4, No. 2, clear flat	$27.00	$27.00
Boards, 1x8, 6 to 20, No. 1 common	15.00	15.00
Dimension, 2x4, No. 1, common	17.00	17.00
Dimension, 2x10, 16, No. 1, common	16.50	16.50
Timbers, 6x6 to 8x8, No. 1	21.00	21.00
Timbers, 3x12 to 12x12, rough	16.00	16.00

Prices for Portland cement in carload lots, not including package, are the same as those quoted in last month's issue.

New York	$2.15	Minneapolis	2.32
Pittsburgh	2.09	Dallas	2.05
New Orleans	2.40	Denver	2.84
Chicago	2.10	San Francisco	2.31
Cincinnati	2.37	Montreal	1.80

Railroad News



Briefly Told

The Baltimore & Ohio, which for the past eight years has used the Pennsylvania station, New York, as its passenger terminal in that city, will on September 1 abandon this station and resume operation into the Central of New Jersey terminal at Jersey City, which was its New York passenger terminal prior to 1918.

Six women have been employed as highway crossing guards on the St. Louis division of the Pennsylvania since October, 1918, and their records are characterized as perfect, there having been no accidents at the crossings at which they are stationed during this period. Two sisters are located at Terre Haute, Ind., and the daughter of a retired railroad foreman is located at Jewett, Ill. The others are stationed at Highland, Ill., Teutopolis and Collinsville.

Revenue freight car loadings for the week ended April 3, totaling 928,092 cars, showed an increase of 4,692 cars over the same week of last year, although it was a decrease as compared with the preceding week. Cumulative totals for the first 14 weeks in 1926 were 12,913,690 compared with 12,705,809 for the corresponding period in 1925. The freight car surlus for the week ended March 31 averaged 246,549 cars, including 104,280 coal cars and 95,478 coal cars.

The New York Central, on Saturday, April 17, celebrated the one hundredth anniversary of the charter of the Mohawk & Hudson between Albany and Schenectady, now a part of the main line of the New York Central. The Mohawk & Hudson began operation on August 9, 1831, the first train being drawn by the DeWitt Clinton, a four-wheel locomotive. It is claimed for the Mohawk & Hudson that it was the first railroad in America which has been a steam road from the date of its initial operation.

The Southern Pacific is now running passenger trains between El Paso, Tex., and Houston, a distance of 832 miles, without changing engines, thus exceeding slightly the longest runs previously made on the same road between El Paso, Tex., and Los Angeles, Cal., 815 miles. Five locomotives are now used in hauling two trains in each direction daily, one locomotive being held in reserve. The saving in locomotives is indicated by the fact that only a few years ago five engines were used to draw a single train between these terminals.

A four months' safety campaign, consisting of a series of six rallies recently held in Toledo, Ohio, was participated in by all of the 14 railroads centering in that city. These rallies were conducted by the Railway Safety committee of the Toledo Safety Council, G. E. Husted, chairman, the cost being borne by the railroads in proportion to the attendance of their employees. Well-known speakers were brought in from various cities, and each rally was followed by an entertainment and a dance. Prizes were given for attendance.

Freight traffic carried by the Class I railroads in February aggregated 35,414,324,000 net ton miles, according to reports of the carriers to the Bureau of Railway Economics. This was the second largest movement of freight in February on record, having been exceeded only in February, 1924, when the total was 1.6 per cent greater. The total this year exceeded the total of February, 1925, by 5.5 per cent. In the Eastern district the increase over 1925 was 5.7 per cent, in the Southern district 12.5 per cent and in the Western district 2.2 per cent. During the first two months of this year the freight moved by the Class I roads amounted to 73,097,002,000 net ton miles, the greatest for any corresponding period on record, and exceeding by 3.5 per cent the previous high record made in the first two months in 1925.

The Northern Pacific recently completed a record-breaking continuous freight run, handled by a single locomotive, from its Seattle, Wash., freight terminal to its Twin Cities freight terminals, covering a distance of 1,897.6 miles, and crossing three mountain ranges with maximum grades of 2.2 per cent, in 109 hr. 30 min. elapsed time, with a coal-burning locomotive which was not detached from the train nor given any mechanical attention whatever at terminals during the entire trip. An average speed of 17.4 miles an hour was made, including stops which aggregated 4 hr. 43 min. at terminals for tonnage changes.

T. H. Carrow, chairman of the committee on statistics of the safety section, A. R. A., in a circular calling attention to the Interstate Commerce Commission's report of railroad accidents for the last calendar year, reminds operating officers and safety committees that with a comparatively stable working force throughout 1925 there was an increase of 3 per cent in the number of employees killed on duty and a reduction of only 4.8 per cent in the number injured. For the month of December alone the increase in the number killed was 22.5 per cent. The circular suggests increased safety activities be inaugurated, wherever they may be necessary.

At committee meetings of the American Society for Testing Materials held recently at Providence, R. I., the Committee on Steel, of which F. M. Waring, engineer of tests of the Pennsylvania, is chairman, voted to refer to letter ballot for adoption as tentative, new specifications for carbon steel rail. These specifications agree with the 1925 specifications of the American Railway Engineernig Association except that the drop test is to be made with the head of the rail up, instead of the base. Also, as a result of co-operation with the American Railway Engineering Association new specifications are being proposed for steel tie plates and soft steel track spikes. The Committee on Preservative Coatings for Structural Materials is considering the accelerated weathering of paint and means of designating the color of paint materials, as well as a method of determining the elasticity or toughness of the less elastic varnishes.

The Interstate Commerce Commission has issued a preliminary report covering railroad accidents in the United States in the twelve months ending with December, 1925. The number of passengers killed in train accidents as shown in the present report was 83, which is more than double the number reported in either of the last two preceding years. The excess in 1925 over 1924 is more than accounted for by a single derailment, that at Hackettstown, N. J., on June 16, when 45 passengers were killed. The record for 1925 includes also the derailment at Victoria, Miss., on October 27, when 17 passengers were killed, and the collision at Monmouth Junction, N. J., on November 12, when 9 passengers were killed. The total number of persons killed in all accidents in 1925 was 6,766 compared with 6,617 in 1924, while the total number of persons injured was 137,435, as compared with 143,739 in 1924. The total number of persons killed at highway grade crossings in 1925 (included above) was 2,206 and injured, 6,555. These totals for 1924 were 2,149 killed, 6,525 injured; and for 1923, total killed, 2,268; injured, 6,314.

Labor News

Senior Employees Favored

Two bridge and building carpenters on the Denver & Rio Grand Western were promoted to the position of foreman and later demoted on account of a reduction in the number of bridge and building gangs. Subsequently vacancies occurred in the staff of foremen and two other carpenters with shorter service records were promoted. The Brotherhood of Maintenance of Way Employees contended that the two senior men on the roster should have been promoted and entered a claim for the difference in time between what they earned as bridge and building carpenters and what they would have earned as bridge and building foremen. In its decision the labor board held that the senior available employee carried on the seniority roster as foreman should have been assigned to fill the vacancy, but did not go on record in regard to the claim for compensation.—Decision No. 4079.

Yard Gangs Not Necessary to Continuous Operation

According to a recent interpretation by the Labor Board, section foreman and section laborers regularly assigned to perform track maintenance work in yards are not to be considered as "employees necessary to continuous operation of train yards" for the purpose of excluding them from a right to punitive overtime for work on Sundays and holidays. According to the board "it has been the universal practice to relieve this class of employees from Sunday and holiday work except under emergency or other pressing conditions. If section gangs and section laborers are to be considered as coming within the scope of the above quoted phrase there would be no legitimate reason why practically every other class of employees of the maintenance of way department should not be considered in the same category." The decision of the board was that section foremen and their gangs when performing track maintenance work shall be paid at the rate of time and one-half on Sundays and holidays.—Interpretation No. 3 of Decision No. 2687.

Compensation While Traveling in Cabooses

The question was brought before the board as to whether bridge and building department employees who have outfit cars in which to live are entitled to travel time, according to the provisions of Rule 43, while directed to travel during overtime hours on the train in which their outfit cars are being transported, but are required to ride in the caboose rather than in the outfit car. The employees contended that they should be paid while traveling in cabooses because they could not go to bed as would be the case if they were in their own bunk cars and that this was the obvious intent of the provisions of Rule 43. The management contended that Rule 44 applied, which provides for straight time when traveling during the normal working period. It was also the declaration of the carrier that employees required to travel in cabooses beyond their normal retiring time would be compensated for such time in accordance with Rule 43, but that this would not apply for travel during the early evening hours.

The opinion of the board was that the offer of the carriers to compensate as stated above is just and reasonable and decided against the rigid interpretation of Rule 43.—Decision No. 4086.

March earnings of the railroads are being estimated at $20,000,000 to $21,000,000 above last year. Furthermore, the northwestern carriers had the best month since the 1922-'23 depression. Based on reports of 72 roads showing net operating income of $86,808,000, the total for all Class I carriers is indicated at about $93,700,000, compared with $73,116,672 in March, last year, and $63,289,297 in February, this year. Last month's estimated income would represent the month's proportion of an annual yield of 5.74 per cent on the tentative rate making property valuation.

Personal Mention

General

C. F. Urbutt, acting division superintendent and formerly a construction engineer on the Chicago, Milwaukee & St. Paul, with headquarters at Savanna, Ill., has resigned to take charge of the construction and operation of a 150-mile narrow gage line in Chile for the Guggenheim interests.

Emmett S. Brannan, water service foreman on the Yazoo & Mississippi Valley, a subsidiary of the Illinois Central, has been promoted to supervisor of water service of the Memphis division, with headquarters at Memphis, Tenn., succeeding his father who died on February 3, as noted elsewhere in this issue.

W. C. Hurst, formerly vice-president and general manager of the Chicago, Peoria & St. Louis, and for a number of years connected with the engineering department of the Chicago, Burlington & Quincy, has been appointed senior vice-president of the Illinois Midland, which will operate, under lease, the Springfield, Havana & Peoria, using trackage over the Illinois Central between Pawnee Junction, Ill., and Springfield to connect the two properties.

W. B. Wood, general superintendent of the New Jersey division of the Pennsylvania, with headquarters at New York, and formerly connected with the engineering department of the same road, has been furloughed on account of injuries received in an automobile accident last September and will be assigned to duty at the expiration of his leave of absence. Due to changes made on this account, the following officers, of engineering training, have been assigned to new positions: **R. K. Rochester,** now general superintendent of the Northern division, with headquarters at Buffalo, N. Y., will succeed Mr. Wood. **F. D. Davis,** acting general superintendent of the New Jersey division, has been appointed general superintendent of transportation, Western region, with headquarters at Chicago; **D. Y. Geddes,** superintendent of the Toledo division, has been transferred to Pittsburgh as superintendent of the Panhandle division and has been succeeded by **R. C. Miller,** who has been superintendent of the Schuylkill division. **R. R. Nace,** engineering maintenance of way of the Eastern Ohio division, has been promoted to superintendent of the Schuylkill division, with headquarters at Reading, Pa., succeeding Mr. Miller.

Mr. Davis was born at Baltimore, Md., on March 21, 1885, and was educated at the Baltimore Polytechnic Institute. He entered railroad service on March 1, 1903, as a levelman on the Pennsylvania, being promoted to transitman on January 15, 1906, and to assistant supervisor on January 15, 1907. He was promoted to supervisor on June 16, 1913, and was made assistant freight trainmaster on April 1, 1918. He was promoted to division engineer on March 1, 1920, and to superintendent of the Norfolk division on July 1, 1922, being transferred to the New York division on October 24, 1923. On October 16, 1925, Mr. Davis was promoted to acting general superintendent of the New Jersey division, which position he was holding at the time of his recent promotion.

Engineering

Reuben T. Robinson, assistant bridge engineer on the Pere Marquette, has resigned to engage in bridge construction.

C. H. Owen has been appointed acting division engineer on the Mobile & Ohio, with headquarters at Meridian, Miss., succeeding **John M. Southgate.**

C. E. Coryell, instrumentman on the Minneapolis & St. Louis, has been promoted to assistant engineer, with headquarters at Minneapolis, Minn.

W. A. Roderick, engineer maintenance of way of the Wheeling & Lake Erie and the Lorain & West Virginia, has been appointed engineer maintenance of way and struc-

tures, with headquarters at Brewster, Ohio. **T. J. Williams** has been appointed special engineer in charge of surveys and construction, and will perform such duties as may be assigned to him. He will have headquarters at Cleveland, Ohio. The office of chief engineer has been abolished.

N. C. Pearson, assistant engineer on the Union Pacific (Oregon-Washington Railroad & Navigation unit), has been promoted to division engineer.

E. F. Schulz has been appointed assistant chief engineer of the Springfield, Havana & Peoria, formerly a part of the Chicago, Peoria & St. Louis, with headquarters at Springfield, Ill.

H. B. Holmes has been appointed chief engineer of the Georgia & Florida, with headquarters at Augusta, Ga., succeeding **R. W. Jones, Jr.,** who has resigned to accept service with another company.

L. P. O. Exley, formerly engineer of maintenance of way of the Gulf, Mobile & Northern, has been promoted to chief engineer with headquarters at Mobile, Ala., succeeding **H. S. Jones,** who has been appointed valuation engineer with the same headquarters.

W. L. Darden has been appointed senior assistant engineer of the Seaboard Air Line. **J. C. Williams** has been appointed engineer of buildings. **L. N. Riggan** has been appointed assistant engineer, and **L. C. Holt** has been appointed right-of-way engineer. All will have headquarters at Savannah, Ga.

H. E. Berg, assistant engineer in charge of the drafting room at regional headquarters of the Canadian National, at Winnipeg, Man., has been promoted to assistant to the chief engineer, with the same headquarters, succeeding **J. E. Davison,** whose promotion to district engineer, Manitoba district, was noted in the April issue.

G. A. Phillips has been appointed engineer maintenance of way of the Lehigh Valley, succeeding G. L. Moore, who resigned to enter other business as announced in the April issue. E. J. Cullen has been appointed division engineer of the Seneca division, succeeding Mr. Phillips, and H. M. Fearon has been appointed division engineer of the Auburn division, succeeding Mr. Cullen. Mr. Phillips was born on September 28, 1889, at Dorchester, Mass., and graduated from the University of Maine in 1911. He entered railway service in February, 1912, with the Lehigh Valley, and was a levelman and transitman until September 15, 1915, when he was promoted to assistant engineer of the Seneca division, which position he held until April 15, 1916. From that date to November 15, 1916, he was supervisor of track of the M. & H. division of the same road, with headquarters at Delano, Pa. He was promoted to division engineer of the same division, with headquarters at Hazleton, Pa., in November, 1916, and on August 1, 1920, was transferred to the Seneca division, which position he was holding at the time of his recent appointment as engineer maintenance of way.

Changes on the Pennsylvania

The organization of the engineering department of the Pennsylvania has been changed in order to place an assistant chief engineer at Chicago and an additional assistant chief engineer, at Pittsburgh. **W. D. Wiggins,** chief engineer maintenance of way, Central region, will assist with engineering work on the Central region, with headquarters at Pittsburgh, and **T. J. Skillman,** chief engineer maintenance of way, Western region, will have charge of similar work on the Western region, with headquarters at Chicago. **W. L. Ekin,** superintendent of the Philadelphia division, has succeeded Mr. Skillman as chief engineer maintenance of way, Western region, and **J. B. Baker,** engineer maintenance of way, Eastern Pennsylvania division, has succeeded Mr. Wiggins at Pittsburgh. **W. F. Miller,** division engineer of the Maryland division, has been appointed engineer maintenance of way of the Eastern Pennsylvania division, succeeding Mr. Baker. **M. Lipman,** division engineer of the Philadelphia Terminal division of the Pennsylvania, with headquarters at West Philadelphia, Pa., has been transferred to the Maryland division with headquarters at Wilmington, Del., succeeding **F. Miller. J. H. Cooper,** supervisor, with headquarters at New York, has been promoted to division engineer of the Philadelphia Terminal division, in place of Mr. Lipman. **E. D. Flad,** supervisor, with headquarters at Trafford, Pa., has been promoted to division engineer of the Eastern division, with headquarters at Pittsburgh, Pa., succeeding **W. E. Guignon,** promoted to engineer maintenance of way of the Eastern Ohio division.

T. J. Skillman was born on November 6, 1876, at Trenton, N. J., and was graduated as a civil engineer from Princeton University in 1898. He entered railway service in March, 1899, as a rodman on the Pennsylvania, later being employed as a transitman. In December, 1902, Mr. Skillman was promoted to assistant supervisor on the Tyrone division and in August, 1905, was promoted to supervisor on the Pittsburgh division. In June, 1913, he was promoted to division engineer of the New York, Philadelphia & Norfolk and in December, 1914, was transferred to the West Jersey & Seashore. Mr. Skillman was promoted to principal assistant engineer of the Eastern Pennsylvania division in November, 1919, and held that position until March, 1920, when he was promoted to chief engineer maintenance of way of the Northwestern region, with headquarters at Chicago. He was appointed chief engineer maintenance of way of the Western region when it was formed through the consolidation of the Northwestern and the Southwestern regions, and held that position until his recent promotion.

T. J. Skillman

William D. Wiggins was born on April 28, 1873, at Richmond, Ind., and graduated from the Rose Polytechnic Institute at Terre Haute, Ind., in 1895. He entered railway service in September, 1895, with the Pennsylvania Lines West of Pittsburgh, and served until June 12, 1901, as assistant on the engineer corps and assistant engineer on the Pittsburgh division. From June 16, to October, 1901, he was engineer maintenance of way on the Cincinnati & Muskingum Valley division at Zanesville, Ohio, and from October, 1901, to November 1, 1912, was engineer maintenance of way on the Cleveland & Marietta division at Cambridge, Ohio; on the Toledo division at Toledo, Ohio, and on the Pittsburgh division of the same road at Pittsburgh, Pa., successively. On the latter date he became superintendent of the Peoria division of the Vandalia (now a part of the Pennsylvania), at Decatur, Ill., which position he held until July 1, 1913, at which time he was appointed valuation engineer of the Pennsylvania Lines West of Pittsburgh, with headquarters at Pittsburgh, Pa. He remained in this position until March 1, 1920, when he became chief engineer maintenance of way of the Central region of the Pennsylvania System, with headquarters at Pittsburgh, Pa., which position he was holding at the time of his recent promotion to assistant chief engineer.

William L. Ekin, who has been appointed chief engineer maintenance of way of the Western region with headquarters at Chicago, was born on September 18, 1879, at Xenia, Ohio. He was educated at Ohio Wesleyan University and at the Case School of Applied Science, and entered railway service on July 16, 1900, on the Cincinnati division of the Pennsylvania. In September, 1905, he became assistant engineer on the Michigan division of the Vandalia (now part of the Pennsylvania), and on May 1, 1907, was promoted to engineer of the same division. On July 1, 1913, he was transferred to the St. Louis division, and on February 11, 1918, he became superintendent of the Peoria division, and until October 24, 1923, was successively superintendent of the Michigan division, the Conemaugh division and the Phila-

delphia division. On the latter date he became general superintendent of the Northern division, and on January 16, 1924, superintendent of the Philadelphia division, which position he was holding at the time of his recent appointment as chief engineer maintenance of way.

J. B. Baker, who has been appointed chief engineer maintenance of way of the Central region of the Pennsylvania, was born on December 20, 1882. He graduated from the University of Pennsylvania in 1905 with the degree of civil engineer and entered railway service on July 1, 1905, with the construction corps of the Pennsylvania, being appointed assistant supervisor in 1910. In the spring of 1916 he was transferred to special duty in the office of the general manager at Philadelphia, and after various assignments and promotions was appointed engineer maintenance of way, with headquarters at Cleveland for the newly organized Lake division after the termination of federal control in March, 1920, On April 1, 1923, he was transferred to the Eastern Pennsylvania division, with headquarters at Harrisburg, Pa., where he remained until the time of his recent appointment.

William F. Miller, who has been appointed engineer maintenance of way of the Eastern Pennsylvania division of the Pennsylvania, was born on June 21, 1880, at Philadelphia, Pa., and attended the grammar schools of that city. He entered the service of the Pennsylvania in 1892 as a messenger in the train dispatcher's office of the Philadelphia division of West Philadelphia. He attended night school for several years and from 1901 to 1903 studied railroad engineering. On July 8, 1903, he was placed on the engineers' corps of the Philadelphia Terminal division of the Pennsylvania, where he continued his studies. He was promoted to transitman at Altoona, Pa., on March 6, 1906, and on January 15, 1907, was promoted to assistant supervisor with the same headquarters. He Became assistant supervisor of track at York, Pa., on December 1, 1908, and main line assistant supervisor on the New York division at Trenton on August 1, 1910. He was promoted to supervisor and assistant trainmaster on the Williamsport division at Lewisburg, Pa., on July 15, 1913, and on August 1, 1914, was transferred to the office of the valuation engineer of the Pennsylvania at Philadelphia as pilot engineer and cost engineer. Mr. Miller became supervisor of the West Jersey and Seashore, with headquarters at Atlantic City, N. J., in October, 1917, and was successively supervisor of the South Philadelphia track elevation, and a supervisor on the Philadelphia Terminal division at West Philadelphia. On March 1, 1920, he was promoted to division engineer of the Williamsport division at Williamsport, Pa., and on May 1, 1920, was transferred to the Maryland division, with headquarters at Wilmington, Del., which position he was holding at the time of his recent appointment.

W. F. Miller

Walter E. Guignon, who has been appointed engineer maintenance of way of the Eastern Ohio division of the Pennsylvania, with headquarters at Pittsburgh, Pa., was born on August 5, 1873, at Corry, Pa., and graduated from the Case School of Applied Science in 1899. He entered railway service on July 1, 1901, as assistant on the engineers corps of the Pennsylvania at New Castle, Pa. On July 23, 1913, he was appointed assistant division engineer, with headquarters at Chicago, and on March 1, 1914, he was promoted to the position of division engineer in which capacity he was located in turn at Zanesville, Ohio, Logansport, Ind., Canton, Ohio, and Pittsburgh, Pa., until his recent advancement to engineer maintenance of way.

Track

W. A. Thaxton has been appointed general foreman on the Southern Pacific with temporary headquarters at Dunsmuir, Calif.

W. W. Portser has been appointed supervisor on the Pennsylvania at Trafford, Pa., succeeding **E. D. Flad,** whose promotion to division engineer of the Eastern division is noted in another column.

M. R. Palmer, section foreman on the Atchison, Topeka & Santa Fe, has been promoted to roadmaster at Raton, N. M., succeeding **J. E. Truitt,** who has been transferred to Las Vegas, N. M., where he succeeds **J. H. Elliott,** retired.

R. D. Brown, roadmaster of the First district of the Arizona division of the Atchison, Topeka & Santa Fe, with headquarters at Kingman, Ariz., whose leave of absence was noted in the April issue, has resumed his duties.

John Wagner, assistant supervisor on the Reading, with headquarters at Pottsville, Pa., has been appointed acting supervisor at Mahanoy Plane, Pa., succeeding **P. G. Jefferis,** who has been granted a leave of absence on account of illness. **J. H. Olcott,** assistant supervisor of the Wilmington & Columbia division, with headquarters at Reading, Pa., has resigned. **C. F. Forstall,** assistant supervisor on the Reading division, with headquarters at Reading, has been transferred to the Wilmington & Columbia division, with the same headquarters, succeeding Mr. Olcott. **N. N. Bailey,** assistant supervisor at Harrisburg, Pa., has been transferred to the Reading division, with headquarters at Reading, succeeding Mr. Forstall. **R. W. G. Morrison,** transitman, has been promoted to assistant supervisor at Harrisburg, succeeding Mr. Bailey. James F. Sherron, Jr., has been appointed acting supervisor with headquarters at Philadelphia, Pa., succeeding John T. Sturman, transferred.

P. J. McNulty, assistant supervisor of track on the Lehigh Valley, with headquarters at South Plainfield, N. J., has been promoted to supervisor of track on Sub-division No. 4, with headquarters at Geneva, N. Y., succeeding **John Dinan,** resigned. Mr. McNulty was born on November 12, 1880, at Pittston, Pa., and entered railroad service in 1905 as timekeeper for the Lehigh Valley, since which time he has been successively clerk to the supervisor of track, assistant foreman and assistant supervisor of track for the same company.

The Chicago, Milwaukee & St. Paul has inaugurated the practice of assigning one large rail-laying gang to each district of its Eastern Lines, and has placed **J. T. Loftus,** roadmaster, with headquarters at Wausau, Wis., in charge of the gang assigned to the Middle district. **John Whelan,** roadmaster, with headquarters at Prairie du Chien, will have charge of the gang assigned to the Southern district, while the gang on the Northern district will be in charge of **A. J. Barbee. B. J. Deneen** and **W. Hickey** have been appointed assistant roadmasters in charge of the territories of Mr. Loftus and Mr. Whalen, respectively, during their absence.

Bridges and Buildings

J. G. Frank has been appointed supervisor of buildings on the New York Central, with headquarters at Elkhart, Ind., succeeding **A. W. Davis,** retired.

Purchasing and Stores

Lee F. Blood has been appointed purchasing agent of the Green Bay & Western, succeeding H. E. Dutton, deceased. **Thurman A. Stinson** has been appointed storekeeper, succeeding E. C. Juley, deceased.

E. T. Campbell and **E. Curtis** have been appointed division storekeepers on the Chesapeake & Ohio, with headquarters respectively at Russell, Ky., and Ashland, Ky. **R. H. Rutman** has been appointed assistant division storekeeper, with headquarters at Russell.

J. L. Cowan, tie and timber agent of the Southern Pacific, lines in Texas and Louisiana, and formerly purchasing agent of the San Antonio & Aransas Pass, has been promoted

to assistant purchasing agent of the lines in Texas and Louisiana, with headquarters at Houston, Tex.

O. V. Daniels, assistant general storekeeper of the Pennsylvania, with headquarters at Philadelphia, Pa., has been appointed general storekeeper, with headquarters at Altoona, Pa., succeeding **W. F. Vogt,** who has been transferred to Philadelphia as assistant general storekeeper. These appointments are effective April 1.

Obituary

Patrick J. Sullivan, railway building construction contractor, Denver, Colo., died on April 11.

Ernest C. Juley, general storekeeper of the Green Bay & Western, died on March 5, after a short illness.

Harley E. Dutton, purchasing agent of the Green Bay & Western, died recently, after many months' illness.

Henry Brannan, supervisor of water service on the Memphis division of the Yazoo & Mississippi Valley, a subsidiary of the Illinois Central, with headquarters at Memphis, Tenn., died on February 3 after a period of service covering almost 50 years with that company.

Charles T. Pease, who was in charge of surveys in connection with the construction of the Rio Grande Southern between Ridgway, Colo., and Durango, and who also at various times served as a civil engineer on the Atchison, Topeka & Santa Fe, the Union Pacific and the Colorado & Southern, died at Denver, Colo., on March 20, of pneumonia.

Francis E. House, president of the Duluth & Iron Range, and for many years in the engineering departments of several railroads, died suddenly at Janesville, Wis., on April 3. He was born on November 15, 1855, at Houseville, N. Y., and studied engineering and chemistry at Rensselaer Polytechnic Institute at Troy, N. Y. After several years of mining work in Nevada he entered railway service in 1880 in the engineering department of the Chicago, Milwaukee & St. Paul. He was promoted to roadmaster in 1883 and in 1887 was promoted to general roadmaster. In 1890 he was promoted to trainmaster on the Kansas City division. Mr. House was appointed to a position in the engineering department of the Lake Shore & Michigan Southern, now a part of the New York Central, in 1891, and in the following year was appointed engineer maintenance of way of the Pittsburgh & Lake Erie. He was promoted to chief engineer in 1894. He was appointed chief engineer of the Bessemer & Lake Erie in 1896, was promoted to general superintendent in 1897, and to general manager in 1901. Later in the same year he was elected president of the Duluth & Iron Range. During federal control Mr. House served as federal manager on the Duluth & Iron Range and the Duluth, Missabe & Northern.

Trade Publications

Fir Gutters.—The improved O. G. fir gutter for use on buildings subjected to fumes, smoke or acid vapors, such as railroad buildings, is described, and its application illustrated in a 16-page booklet issued by E. M. Long & Sons, Cadiz, Ohio.

Motor Car Accessories.—Mudge & Co., Chicago, has just issued a new circular on motor car accessories, adaptable to all makes and types of motor cars. The items included are wheels, axles, bearings, windshields, gongs, headlights, skids, safety railings and other similar equipment.

Hammered Piston Rings.—Under the title "Richmond Piston Rings," a bulletin has been issued by the Richmond Piston Ring Company, Richmond, Ind., containing a considerable amount of information regarding the electrically-hammered and accurately-balanced piston rings made by this company. The way in which the metal is condensed in the piston rings, uniformly hammered by electricity to assure permanent tension and uniform wall pressure, is explained in the bulletin, which also comments on the 21 operations necessary in making the rings and the great care exercised to secure correct material and precise workmanship.

Construction News

The Atchison, Topeka & Santa Fe will install a water supply system at Winslow, Ariz., at a cost estimated at $100,000. The work includes the digging of ditches and laying of pipe lines with a total length of 30,000 ft., for which a contract has been awarded to R. F. Ware, Los Angeles, Cal. Through a subsidiary company, the Corona & Santa Fe, a connecting line will be constructed from Alberhill, Cal., to Porphyry, a distance of 15 miles. Plans have been prepared for the construction of a 43-stall roundhouse, several small shop buildings and extensive track facilities at Emporia, Kan. The project is estimated to cost approximately $500,000. The construction of the roundhouse and related facilities constitutes the second unit in the Santa Fe's development of a terminal at Emporia. A passenger station and office building have already been constructed.

The Gulf, Colorado & Santa Fe has awarded a contract to Anderson Bros., El Paso, Tex., for the construction of shop buildings at Cleburne, Tex., to cost $205,000.

The Altantic Coast Line has been authorized by the Interstate Commerce Commission to construct a connecting line from a branch line at Thonotassa, Fla., to its West coast main line at Dade City (21 miles) at an estimated cost of $950,000.

The Baltimore & Ohio has awarded a contract to the Vang Construction Company, Cumberland, Md., for the erection of bridge foundations and a retaining wall on the Akron division at Pittsburgh, Pa. The foundations and wall will cost approximately $50,000, respectively. A contract has been made with the same company for the reconstruction of bridges at Aviston, Ill., Marten, O., and Noble, O., to cost respectively $26,000, $28,000 and $21,000. A contract for the reconstruction of a bridge between Farmers, O., and Musselman, to cost approximately $21,000, has been awarded to the Empire Construction Company, Baltimore, Md. The same company has a contract for the reconstruction of a bridge at Beaver Dam, Md., to cost approximately $32,000. A contract has been awarded to the Sheesley & Janney Co., Johnstown, Pa., for the reconstruction of two bridges at Salem, Ill., at an estimated cost of $29,000. A contract for grading for a yard at Ohio Junction, O., to cost approximately $30,000, has been awarded to Bates & Rogers, Cleveland, O. Bids have been asked for the construction of a 500-ton capacity concrete coaling station at Akron Junction, Ohio.

The Boston & Maine has awarded a contract to the Jennison Company, Fitchburg, Mass., for the installation of fire protection in this company's shops, at East Fitchburg, Mass., to cost approximately $42,000.

The Canadian National has awarded a contract to Gibbs Brothers for the construction of the Dunblane-Central Butte branch line in Saskatchewan, reported in the April issue. A roundhouse, yard office, depot and a 100,000 gal. water tank will be constructed at Dunblane, which will be the division point on the new line. It is reported that bids will be received in the near future for the construction of a foundation and superstructure of a passenger station at Edmonton, Alberta, estimated to cost approximately $1,000,000.

The Central of Georgia has awarded a contract to the Roberts & Schaefer Co., Chicago, for the erection of a combination engine coaling and cinder handling plant at Eufaula, Ala.

The Chicago & North Western has prepared plans for the construction of a passenger station at Hawarden, Iowa, to cost approximately $25,000, and will construct a six stall extension to its roundhouse at Long Pine, Neb. The Illinois Commerce Commission has granted authority to the Litchfield & Madison, recently purchased by the North Western, to construct an extension in Madison county, Ill., to connect with the North Western in the vicinity of Benld, Ill. Application of the North Western to the Interstate Commerce Commission for permission to construct part of the connecting link is still pending.

The Chicago, Burlington & Quincy has authorized the construction of an extension to the reclamation plant at Eola, Ill., to have dimensions of 80 ft., by 100 ft. A contract has been awarded to the Roberts & Schaefer Co., Chicago, for the construction of a 175-ton two-track reinforced concrete locomotive coaling station and electric cinder plant at Dayton's Bluff, Minn.

The Chicago, Milwaukee & St. Paul has awarded a contract to the Burrell Engineering & Construction Co., Chicago, for the construction of a grain elevator at Milwaukee, Wis., to cost approximately $500,000, to replace an elevator destroyed by fire some time ago. An expenditure of $250,000 has been authorized for the elevation of the tracks at North Cicero and Montrose avenues, Chicago.

The Cleveland, Cincinnati, Chicago & St. Louis will construct an engine terminal at Riverside Yard, Cincinnati, Ohio, to cost approximately $3,000,000. The improvements will consist of a 37-stall roundhouse with stalls 125 ft. long, a 100-ft. turntable and accessory buildings, water station, etc. The yard work consists of an extension and rearrangement of the present yards, and re-location of the main tracks. The material for the yard will be obtained by excavation from the engine terminal site. Bids for the engine terminal buildings will be received when plans are completed, about May 15.

The Cowlitz, Chehalis & Cascade has awarded contracts for the construction of completed roadbed ready for track laying on part of the 14-mile extension from Lacamas, Ore., southeasterly into Lewis county, estimated to cost $386,000.

The Delaware, Lackawanna & Western has awarded a contract to Roberts & Schaefer Company, Chicago, for the construction of a 1,000-ton reinforced concrete coaling station with a 1,000-ton reinforced concrete gravity sanding plant at East Buffalo, N. Y., to cost approximately $125,000. A contract for grade crossing elimination at Broad street, Clifton, N. J., has been awarded to H. F. Curtis, New York.

The Detroit Connecting has been denied authority by the Interstate Commerce Commission to construct an 86.7-mile line from Delray (Detroit), Mich., to Marine City. The company will now apply for authority to construct a line from Delray to Pontiac.

The Detroit Grand Belt has been denied authority by the Interstate Commerce Commission to construct a 47-mile line from Wyandotte, Mich., to Mt. Clemens.

The Dock Commission of the State of Alabama has been authorized by the Interstate Commerce Commission to construct a line at Mobile connecting docks now being built with the Louisville & Nashville, the Southern, the Mobile & Ohio and the Gulf, Mobile & Northern and extending to a point in Nort Mobile (5.69 miles); estimated cost of construction, $1,608,189.

The Dodge City & Cimarron Valley has applied to the Interstate Commerce Commission for authority for the construction of a line from Manter, Kan., westerly and southwesterly, to a point near Joycoy postoffice, Baca county, Colo., 56 miles, to be operated by the Atchison, Topeka & Santa Fe.

The Florida East Coast has authorized the construction of a station and team track at Little River, Fla., at an approximate cost of $50,000.

The Fort Worth & Denver City is reported to contemplate the relocation of the line between Amarillo, Texas, and Dalhart, a distance of 81 miles.

The Illinois Central is preparing plans for the construction of a one-story brick shop building, 165 ft. by 339 ft., at Chicago, to cost $270,000.

The Lehigh Valley has awarded a contract to Bates & & Rogers, Chicago, for the construction of a double track tunnel 4,850 ft. long near Pattenburg, N. J. The tunnel will be 30 ft. wide and 25 ft. high above top of rail, and will be concrete lined except in rock sections. It will be used to supplement an existing tunnel, which is a double track structure now operated as a single track.

The Maine Central has awarded a contract to Fairbanks, Morse & Co., Chicago, Ill., for the construction of coaling plants at Bangor, Me., Lewiston and Rumford at a total estimated cost of $105,000. This company has applied to the Interstate Commerce Commission for a certificate authorizing an extension of 7,700 feet over a bridge to be built by the state of Maine over the Kennebec river for both railway and highway purposes from Bath to Woolwich. The company is to repay 55 per cent of the cost (not exceeding $3,000,000) in semi-annual installments during a period of 50 years.

The Missouri-Kansas-Texas will soon receive bids for the construction of a freight station and warehouse at Houston, Texas, to cost approximately $1,000,000. The structure will be of reinforced concrete and brick, six stories in height, with dimensions of 191 ft. by 280 ft. A one-story freight house, 53 ft. by 220 ft. will adjoin the main building on one side.

The Missouri Pacific will construct a one-story brick and stucco passenger station at Corning, Ark., at a cost of approximately $30,000. The union passenger station at Texarkana, Ark., which will be constructed jointly by the Missouri Pacific, the Texas & Pacific, the St. Louis Southwestern and the Kansas City Southern, will cost approximately $2,000,000. It will be two stories in height, with dimensions of 50 ft. by 282 ft., and with a one-story mail annex, 40 ft. by 286 ft. The exterior will be finished with facebrick and limestone, and the interior with enameled brick. Floors will be of concrete. The station will have six covered platforms.

The Norfolk & Western has awarded a contract for the construction of several shop buildings at Portsmouth, Ohio, to J. P. Pettyjohn & Co., Lynchburg, Va.

The New York Central has awarded a contract to the Henry P. Burgard Company, Buffalo, N. Y., for the construction of a team driveway at Howard street, that city, at an estimated cost of $40,000. The company has awarded a contract to the T. J. Dailey Construction Company, Batavia, N. Y., for the elimination of a grade crossing at Lewiston road, Oakfield, N. Y., to cost approximately $52,000. A contract has been awarded to the John Johnson Construction Company, Buffalo, N. Y., for the construction of a bridge carrying express and mail tracks of the railroad over William street in that city, at a cost estimated to be $125,000.

The New York, Chicago & St. Louis has awarded a contract to the Austin Company, Cleveland, Ohio, for the construction of a shop building at Frankfort, Ind., to cost $50,000. The new structure will replace a building recently destroyed by fire, as reported in the April issue.

The Northern Pacific has been authorized by the Interstate Commerce Commission to construct a new line from Orofino, Idaho, to Headquarters, 41 miles. Application of the Oregon-Washington for equal joint possession and operation of this line and of an existing Northern Pacific line from Joseph, Idaho, to Stites, 65 miles, has been denied without prejudice. The company has prepared plans for the rebuilding of a bridge across the Mississippi river at Minneapolis, Minn. Strengthening of the bridge, which is 30 years old, has been made necessary by the use of heavier locomotives.

The New York, New Haven & Hartford has ordered from the General Railway Signal Company an all-electric car retarder system for a new yard at Hartford, Conn. The layout for the present will be for 20 tracks but with arrangements for including 20 more tracks later. There will be 29 double retarder units, each 33 ft. long and 20 skate-placing machines, and other apparatus; Model 6 switch machines will be used, but without signals as the floodlighting of the yard and the lever lights in the cabin are deemed sufficient to give necessary information as to the correct position of the switches. This company has authorized the extension of three yard tracks at South Worcester, Mass., at an approximate cost of $119,000 and the construction of 6 additional yard tracks at Cedar Hill (New Haven), Conn., at an approximate cost of $120,000. A contract for the construction of a 7-stall extension to the enginehouse at South Worcester, Mass., to cost approximately $88,000, has been awarded to the E. J. Cross Company, Worcester.

The Pennsylvania has awarded a contract to Walter S. Rae, Pittsburgh, Pa., for the reconstruction of an overhead bridge at Bridge street, Altoona, Pa., to cost approximately

$70,000. Bids have been asked for the construction of a 650-ton capacity reinforced concrete coaling station at Fort Wayne, Ind. A contract has been awarded to the T. J. Foley Company, Pittsburgh, Pa., for remodeling this company's warehouse at Pittsburgh at an approximate cost of $100,000. Contracts have been awarded to the same company for an additional yard at Wierton, W. Va., to cost $130,000, and improvements to the scrap dock at Conway, Pa., to cost approximately $25,000. A contract has also been awarded to the same company for the construction of an overhead bridge at Market street, Marcus Hook, Pa., to eliminate the grade crossing, to cost $400,000, the cost to be shared jointly by the county, township, borough and railroad company. This company plans early electrification of its lines between Philadelphia, Pa., and Wilmington, Del., 27.1 miles and between Philadelphia and West Chester, Pa. 25.5 miles via Media. Work on this step in carrying out the program for the ultimate electrification of all suburban lines in the Philadelphia district will be started soon and is scheduled for completion in 1927. It is estimated that the total cost will approximate $10,000,000 exclusive of new electrically equipped cars which will be required.

The St. Louis-San Francisco has awarded a contract to W. W. Johnson, Springfield, Mo., for the construction of a two story, brick and stucco passenger station at Springfield, Mo., to cost $100,000, as reported in the March issue. Bids will be received until April 12 for the construction of a passenger station at Fayetteville, Ark., to cost approximately $40,000. The station will be one-story in height and of brick and hollow tile construction, with tile roof and concrete floors. An application will be filed with the Interstate Commerce Commission for permission to build an extension from Aberdeen, Miss., to Kimbrough, Ala.

The Southern Illinois & Kentucky has asked for bids for the construction of a 500-ton capacity concrete coaling station at East Blufford, Ill.

The Texas & Pacific, it is reported, will construct an engine terminal and shops at Gouldsboro, La., at a cost of $1,500,000. A contract has been awarded to Ware & Co., El Paso, Tex., for the construction of a passenger station and a freight station at Plaquemine, La., to cost $70,000.

The Union Pacific has awarded a contract to Walter Knutzen & Son, Kearney, Neb., for the construction of a freight and passenger station at Cozad, Neb. The station will be 118 ft. in length and will be of brick and tile construction. Plans have been prepared for the construction of a passenger station at Greeley, Colo., estimated to cost $125,000.

The Wabash has awarded a contract to the Foundation Company, New York, for an addition to the locomotive shop at Decatur, Ill. The extension will be 691 ft. long and 150 ft. wide. A powerhouse 100 ft. by 100 ft. and a wash and locker room 50 ft. by 100 ft. will also be constructed. A contract has been awarded to the Carmichael-Cryder Company, St. Louis, Mo., for the construction of a double track reinforced concrete and steel bridge over the Sangamon river at Decatur, Ill. The bridge will be 1,062 ft. long and with the necessary subway work and street paving in Decatur will cost approximately $850,000. Bids will soon be received for the construction of a one-story car repair shop at Detroit, Mich., estimated to cost $100,000.

Equipment and Supplies

The Brazilian Railway is inquiring for 40 air dump cars of 20 cu. yd. capacity.

The Chicago, Burlington & Quincy has ordered 100 ballast cars from the Rodger Ballast Car Company.

The Pere Marquette has ordered 10 air dump cars of 30 cu. yd. capacity from the Magor Car Corporation.

The Baltimore & Ohio has given a contract for 16, 20 cu. yd. capacity, drop-bottom, air-dump cars to the Koppel plant of the Pressed Steel Car Company.

The Missouri-Kansas-Texas has purchased 375,000 tie plates, developing the order between the Tennessee Coal, Iron & Railroad Co. and the Illinois Steel Company.

Supply Trade News

General

The Rail Joint Company on May 1 will remove its office from 61 Broadway to 165 Broadway, New York City.

The Portland Cement Association has moved its general offices from the Conway building, 111 West Washington street, Chicago, to the association's new building at 33 West Grand avenue. The entire building is occupied by the Portland Cement Association and its research laboratory.

The Kalamazoo Railway Supply Company, Kalamaoo, Mich., has appointed **Stewart Brothers Company,** 271 Pine street, Portland, Ore.; the **Tyee Machinery Company, Ltd.,** Vancouver, Wash.; and the **Hofius-Ferris Equipment Company,** Spokane, Wash., distributors in their respective territories. **F. S. McNamara** has been appointed representative, with headquarters in the Barth Building, Denver, Colo.

The Walter Bates Steel Corporation, Gary, Ind., has been organized to manufacture steel poles, transmission towers, sash and similar products. Officers of the company are: president, **Walter A. Bates,** formerly vice-president of the Bates Expanded Steel Truss Company, East Chicago, Ind.; vice-president, **Luke D. Stapleton;** and secretary, **B. C. Johnson,** formerly sales engineer of the Bates Expanded Steel Truss Company.

The Chicago Pneumatic Tool Company, New York, has acquired the **George Oldham & Sons Company** of Baltimore, Md. The manufactur of the Oldham products will be continued and will be conducted at the Detroit plant, 6201 Second boulevard. The sales will be combined and handled from the Chicago Pneumatic Tool Company's branches now operating in the principal cities, as well as through its domestic and foreign agency connections.

The Universal Generator Company, Blossburg, Pa., manufacturer of portable carbide flood lights and accessories, has made the following sales connections: **E. H. Batchelder, Jr.,** district sales agent for the Chicago district with office at 1038 Transportation building, Chicago; **C. B. Irish,** district sales agent for the St. Louis district, with office at 2091 Railway Exchange building, St. Louis, Mo.; **Joseph F. Leonard,** district sales agent for the southeastern district, with office at 1237 Mutual building, Richmond, Va.; **Pittsburgh Supply Company,** 435 Water street, Pittsburgh, Pa., representative in the Pittsburgh district, and **E. L. Ruby,** 1338 Real Estate Trust building, Philadelphia, Pa., general sales representative for the company.

Personal

Blaine S. Smith, general sales manager of the Universal Portland Cement Company, Chicago, has been elected a vice-president.

C. C. Fredericks, formerly associated with S. F. Bowser & Co., Inc., Ft. Wayne, Ind., has been elected president and general manager of the St. Louis Pump & Equipment Company, St. Louis, Mo. **Sherwood Hinds** has been elected chief engineer and vice-president.

Fred A. Poor, president of the P. & M. Company, Chicago, and the Maintenance Equipment Company, Chicago, has been elected chairman of the board of directors of the P. & M. Company. **P. W. Moore,** vice-president of the P. & M. Company, has been elected president succeeding Mr. Poor. **Fred A. Preston,** vice-president of the P. & M. Company, has also been elected president of the Maintenance Equipment Company succeeding Mr. Poor.

Albert Roberts, formerly sales and service engineer of the Grip Nut Company, Chicago, and prior to that time with the mechanical department of the Nashville, Chattanooga & St. Louis, has been appointed district manager of the Duff Manufacturing Company, Pittsburgh, Pa., with headquarters in the Candler Building, Atlanta, Ga., where he will have charge of that company's southern territory. **George E. Watts** who

has been identified with the same company for a number of years, has been appointed special representative with headquarters at Atlanta and will undertake special duties in the southern and other districts.

F. O. Farey, chemical engineer of the Robert W. Hunt Company, Ltd., Montreal, has been appointed manager of the Montreal office. No change has been made in the personnel of its offices at Toronto, and Vancouver, or in the conduct of their inspection and testing work.

The Kalamazoo Railway Supply Company, Kalamazoo, Mich., has opened an office at 50 Church St., New York, in charge of **J. E. Murray** and **H. M. Clawson,** who will conduct its Eastern domestic and export sales. Mr. Murray was born at Carbondale, Pa., and entered railway service in October, 1906, as a stenographer in the division engineer's office of the Erie. From 1906 to July 1909, he was employed by the Erie in various clerical and stenographic positions, when he was promoted to secretary to the president, remaining in this position until September, 1915. In February, 1916, was appointed secretary to the vice-president of the Delaware and Hudson, resigning in February, 1917, to enter the employ of the Buda Company, with headquarters in New York. In October, 1917, he entered the army as a private, serving overseas from October 29, 1917, until August 1, 1919. He was commissioned a first lieutenant on April 2, 1918, and promoted to captain on February 17, 1919, during which period he had charge of hospital trains, with headquarters at Tours, France. Upon his return from overseas service he again entered the service of The Buda Company and was appointed eastern sales manager and export sales manager in 1921, occupying the latter positions until his recent resignation.

J. E. Murray

Mr. Clawson resigned as the assistant eastern sales manager of The Buda Company, New York, on April 1, to enter the employ of the Kalmazoo Railway Supply Company. He was born at Matamoras, Pa., and entered railway service on October 1, 1904, as a clerk in the general manager's office of the Erie. On January 1, 1914, he was promoted to chief clerk to the superintendent and on June 1 of the same year he was made chief clerk to the general manager, which position he held until January 1, 1915, when he was promoted to assistant chief clerk to the vice-president. From November 15, 1916, to March 1, 1920, he held the position of chief clerk to the vice-president and on the latter date he resigned to enter the employ of the Locomotive Feed Water Heater Company, with headquarters at New York, where he remained until March 1, 1921, when he entered the employ of the Franklin Railway Supply Company, Inc., as assistant to the vice-president, with headquarters at Chicago, resigning February 1, 1923, to accept employment with The Buda Company at New York, where he had been located until his recent appointment.

H. M. Clawson

Forest Kaufman, district manager in charge of the Kansas City and Oklahoma City offices of the Portland Cement Association, with headquarters in Kansas City, Mo., has been promoted to manager of the southwest district, with the same headquarters.

J. Reis, vice-president of the United States Steel Corporation at New York, has resigned and will retire from active business. Mr. Reis was vice-president of the steel corporation from 1911, and previously was assistant to the president.

Harlan A. Pratt has been appointed manager of the oil and and gas engine department of the Ingersoll-Rand Company, New York. Mr. Pratt formerly served in the sales department of the Westinghouse Electric & Manufacturing Company, later becoming sales manager of the Atlantic Elevator Company, agents in the east for Westinghouse gearless traction elevators. For the past three years he has been sales manager of the Elevator Supplies Company, Hoboken, N. J.

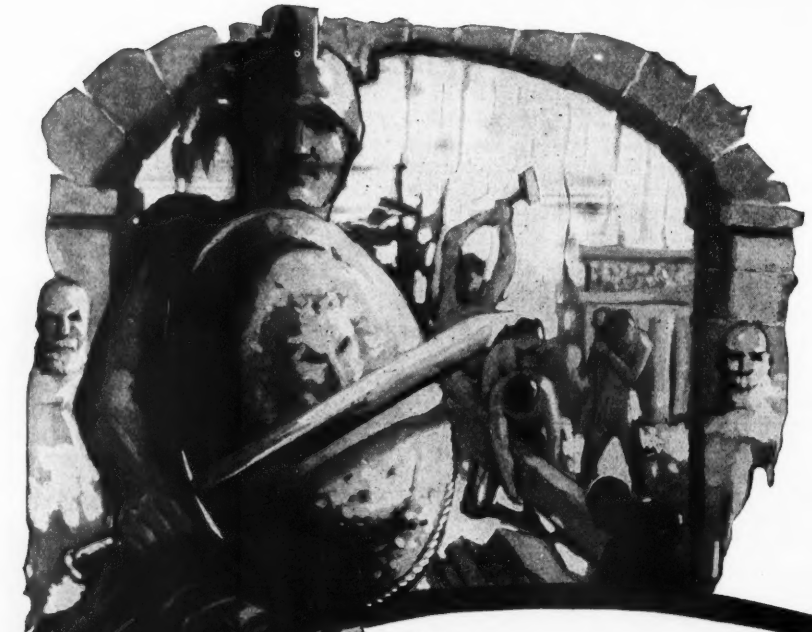
H. B. Pflasterer, whose appointment as railroad sales engineer for S. M. Bowser & Co., Inc., Ft. Wayne, Ind., was noted in the April issue, was born in California, Pa., on March 4, 1878. During 1896 and 1897 he worked in various departments of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Pa. In March, 1898, he entered the employ of the Chicago & Eastern Illinois at Danville, Ill., working in various departments and finally entering the signal department. He was promoted to division signal maintainer in January, 1901, with headquarters at Mt. Vernon, Ill., and remained in that position until January, 1904, at which time he entered the signal department of the Nashville, Chattanooga & St. Louis at Nashville, Tenn., occupying the positions of signal foreman, general signal foreman, signal supervisor and general signal inspector. On May 1, 1917, he was appointed sales engineer for the Hazard Manufacturing Company, which position he has held until his recent appointment.

H. B. Pflasterer

H. N. Nilssen, formerly manager in charge of the Western Steel Products Company, Minneapolis branch, has recently been appointed Sales Manager for the **Zenith Shovel Company,** Madison Terminal Building, Chicago, Illinois.

Edwin S. Mills, general manager of sales of the Illinois Steel Company, Chicago, has been elected a vice-president. Beside being general manager of sales of the Illinois Steel Company he is manager of sales of the Tennessee Coal, Iron & Railroad Company, and of the Carnegie Steel Company, all subsidiaries of the United States Steel Corporation. He was born at New Brighton, Pa., on June 5, 1870, and entered business as manager of sales of the Carnegie Steel Company, Cleveland, Ohio, in 1895. From 1910 to 1919 he was subsequently general manager of the Pittsburgh Steamship Company, agent of the Oliver Iron Mining Company, assistant to the vice-president of the United States Steel Corporation at New York, and special sales agent of the Carnegie Steel Company. In 1919 he was promoted to general manager of sales of the Illinois Steel Company, which position he has held until his recent election.

Floodlight Projectors.—The Crouse-Hinds Company, Syracuse, N. Y., has issued Bulletin No. 2083 descriptive of short range Imperial floodlight projectors.



"Now while the three were tightening
Their harness on their backs,
The consul was the foremost man
To take in hand an axe,
And fathers mixed with commons,
Seized hatchet, bar, and crow,
And smote upon the planks above
And loosened the props below."
—Macaulay.

Horatius at the Bridge

EVERYBODY knows the famous poem describing Horatius defending the bridge which gave entrance to ancient Rome.

History tells us that Roman armorers, with their trusty steel and crafty workmanship, play no small part in both conquest and defense.

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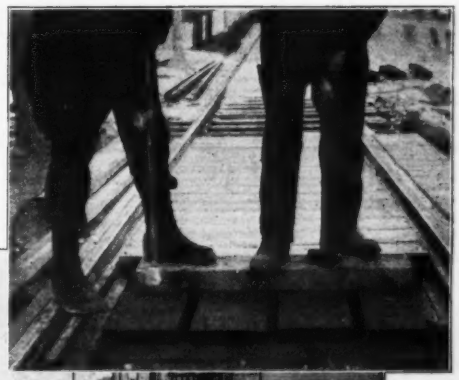

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Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. A. Simmons, who, having been duly sworn according to law, deposes and says that he is the President of the Simmons-Boardman Publishing Co., publisher of *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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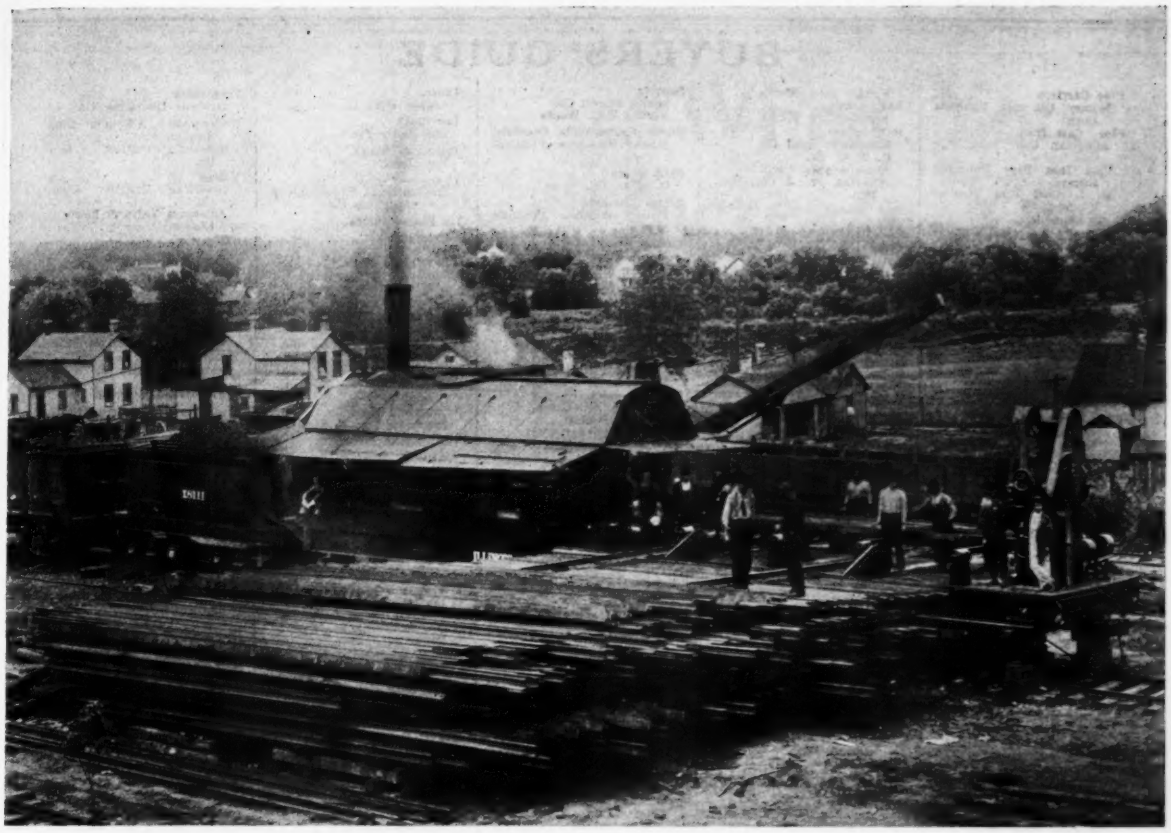

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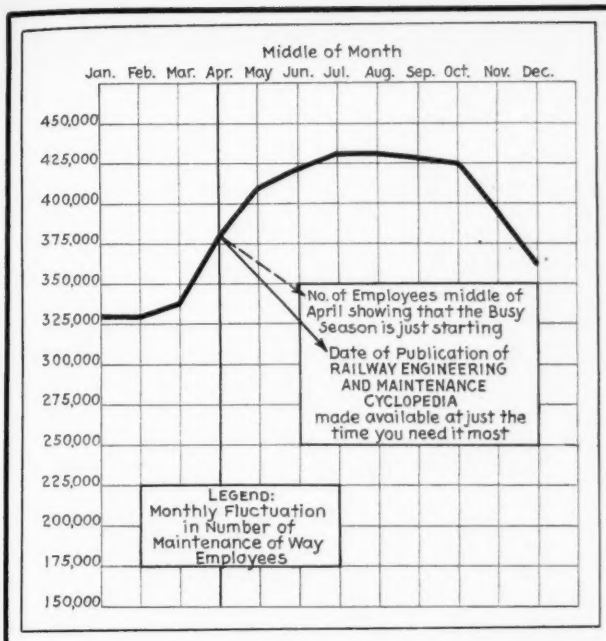

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